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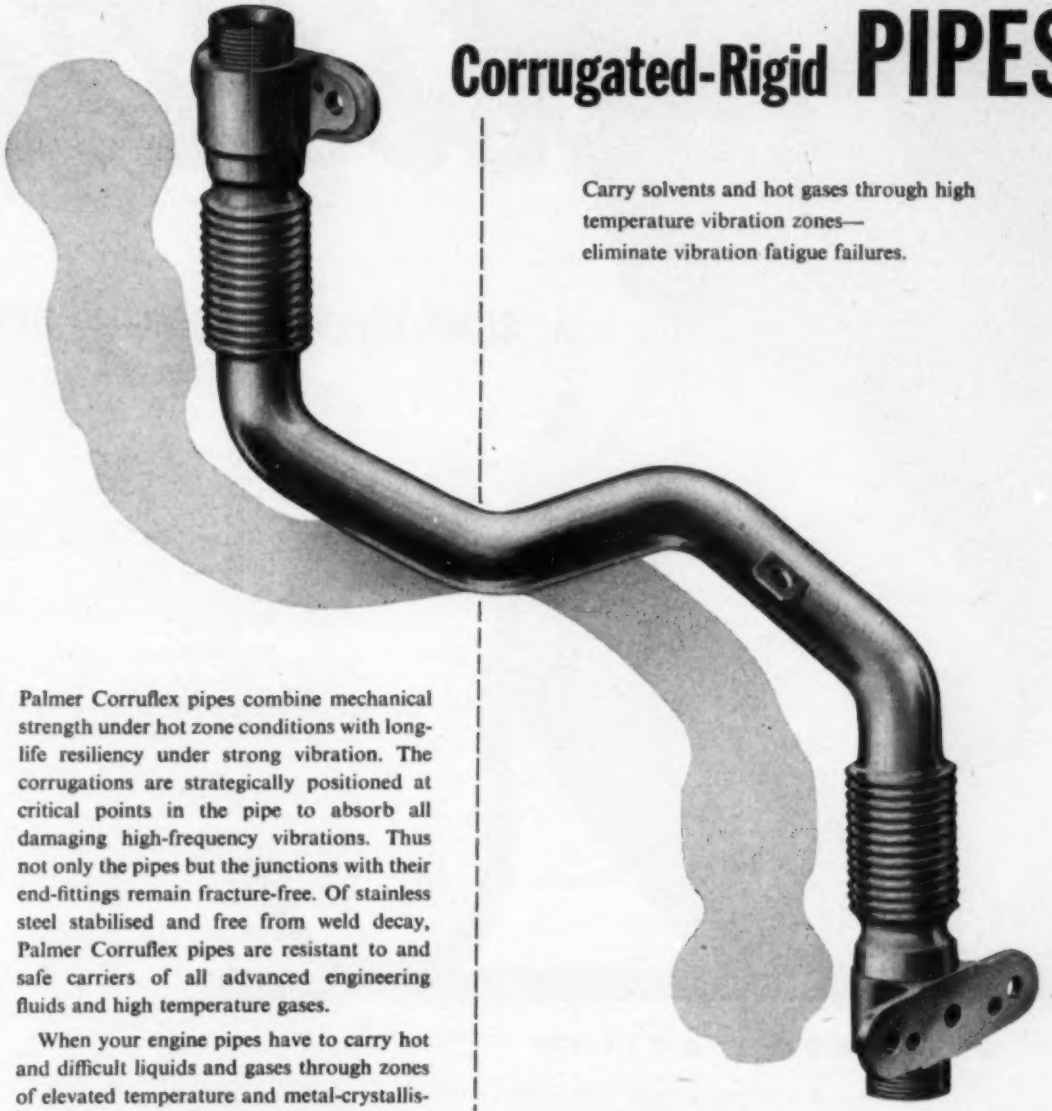

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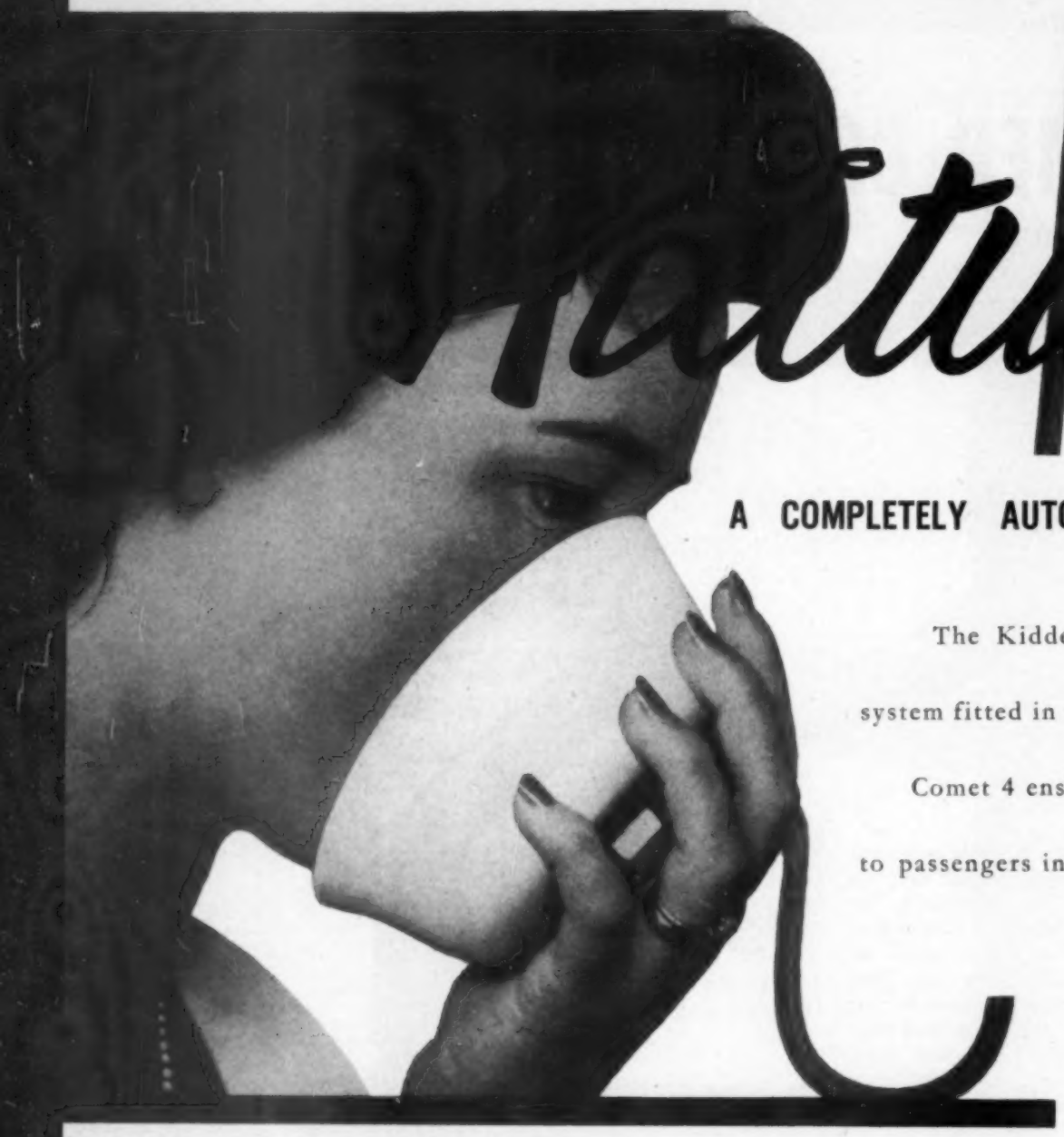

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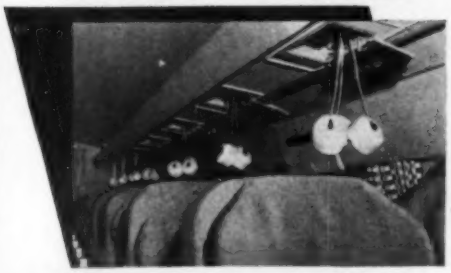

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The system will, in the event of cabin depressurisation, automatically present an oxygen mask above the head of every passenger. The action of pulling the mask to the face admits the supply of oxygen.

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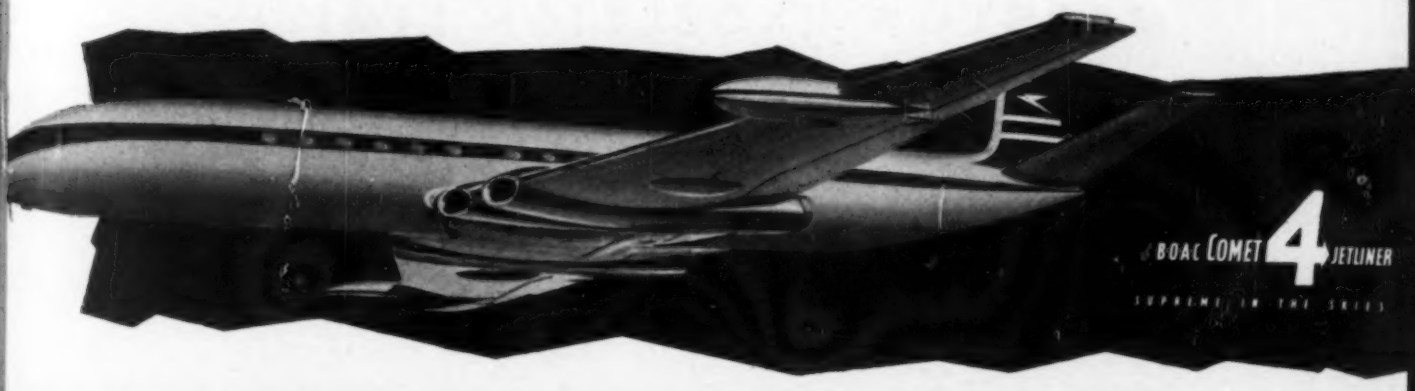

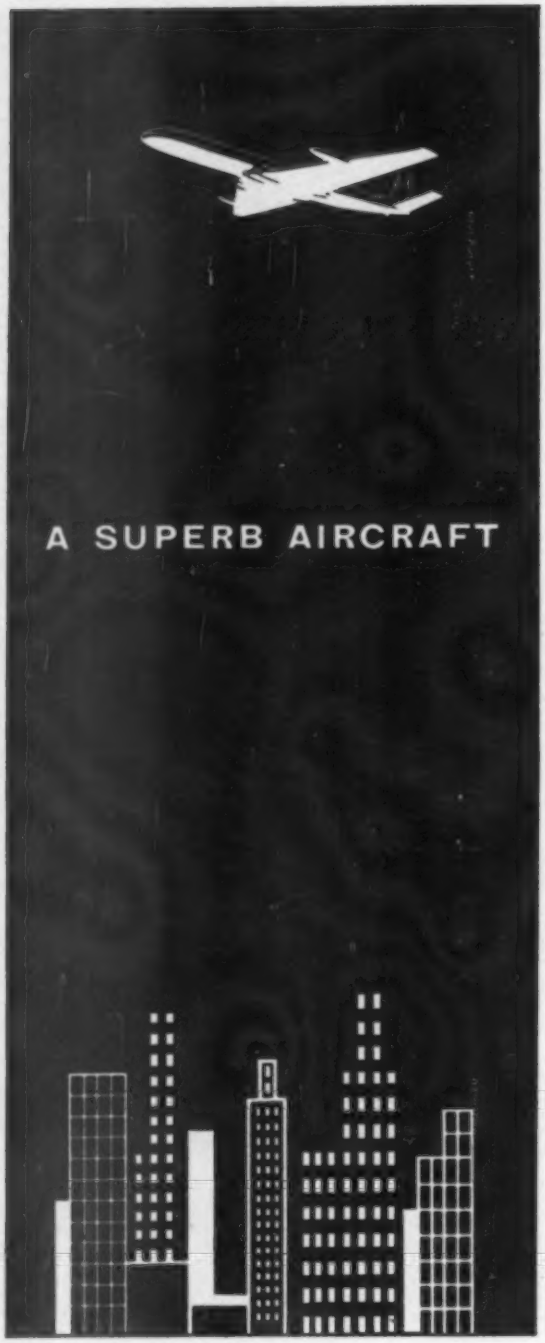

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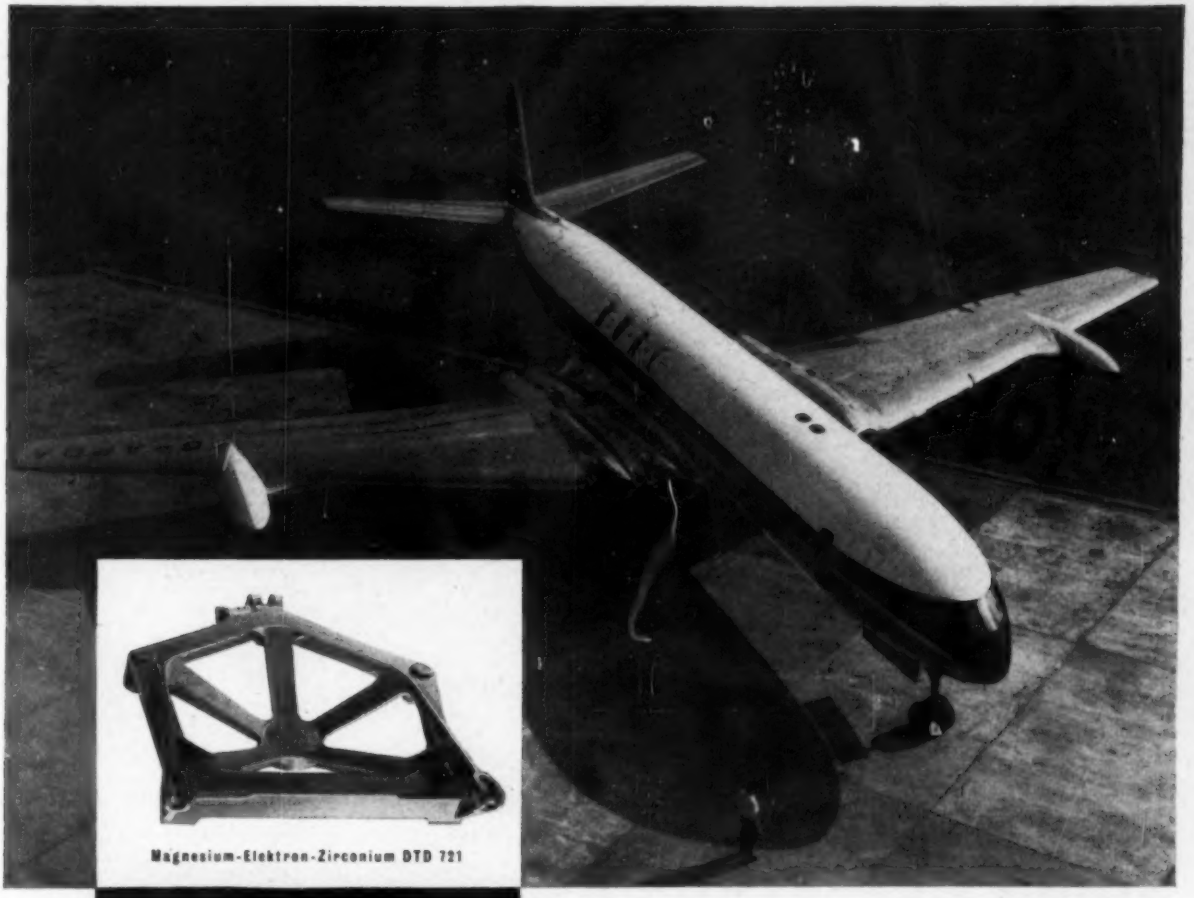

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P.3343

Radio break-downs...

a detailed investigation into the causes of 600 receiver failures

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600 receiver repairs, a service engineer gives
invaluable guidance on radio fault-finding—
lists causes of breakdown in frequency of occurrence order.
Also, how to convert a surplus ARR3 to a v.h.f. broadcast receiver—
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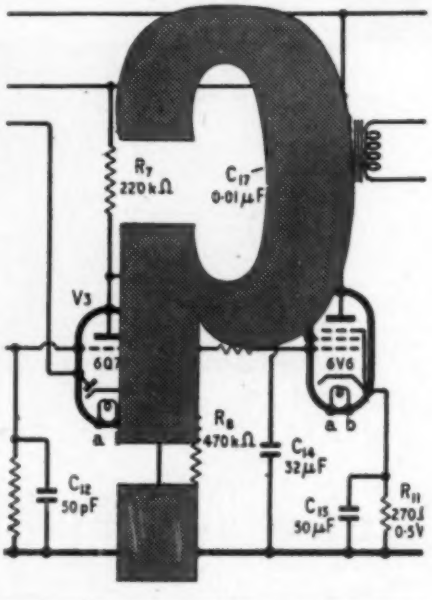
All in November WIRELESS WORLD



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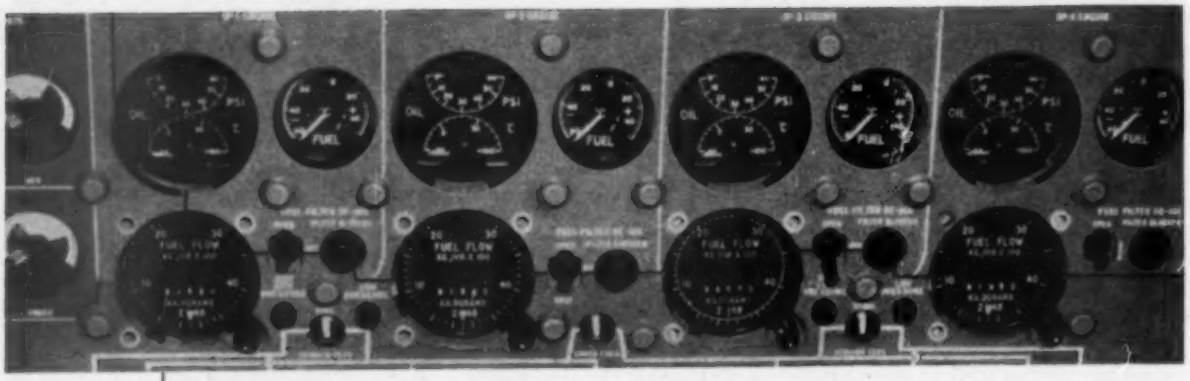

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It's not a little gadget and they'd never put it on a plane—it's bigger than this Renault. They put it in the line between the storage and aircraft tanks to make sure the plane gets clean, water-free fuel.

That's the trouble with your infantile modern engines—they have to be fed on strained foods or they get indigestion. Now look at Dotty . . .

Exactly. Do you really think she enjoys having that steam pouring through her exhaust? Now if you took a Simmonds Fram Separator Filter in tow you could have 100% water separation and complete filtration of solids down to 5 microns.

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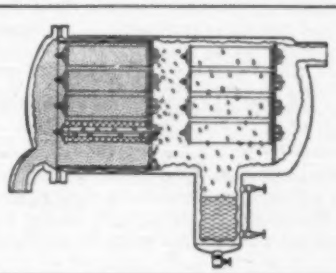

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BRITISH OVERSEAS AIRWAYS CORPORATION

FIRST AERONAUTICAL WEEKLY IN THE WORLD FOUNDED 1909

FLIGHT
and
AIRCRAFT ENGINEER

No 2596 Vol 74 FRIDAY 24 OCTOBER 1958

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The Stuff of Statesmanship

HOW pleasing it is to be able to applaud a Minister for his prescience and resolution in promoting the interests of Britain in the eyes of the world. Only the other week we recorded how, in the international tussle to decide on a common air-navigation system, the Ministry of Transport and Civil Aviation had rallied stoutly round the flying colours of Decca and Dectra. In the terms of their own declaration, they had decided "to arrange a series of demonstration flights in a Comet jet airliner to show observers from a number of different countries the advantages of adopting the well-tried Decca and Dectra systems as an international standard aid to air navigation." Such is the stuff of statesmanship.

Now we have the Minister of Supply lending his own personality as well as his public support to another world-leading British project. In visiting the Blind Landing Experimental Unit at Bedford to study the new technique described in *Flight* last week he was not content merely to bang the British drum ("The adoption internationally of a system of this kind would lead to a great increase in efficiency . . ."). He himself flew in the demonstration Varsity and marvelled at the "hands-off" landing, made possible by the R.A.E. in conjunction with Smiths, Standard Telephones, Murphy and Pye.

To have such close-knit co-operation between Government departments and private companies is good. That it should yield such eminently promising results is even better. That the Ministers responsible should not merely support sound projects, but actively promote them, is best of all.

The Little Ships

WHILE the stately airliners have been sailing high, wide and so very handsome across the Atlantic, numerous small craft have been shuttling to and fro on their own equally lawful occasions. The voyages of these craft—the privately owned "business and touring" machines to which we devoted a special issue the week before last—have been made with increasing frequency and with an outstanding safety record. Perhaps that same record is one reason why their comings and goings have been passed virtually unnoticed, although, as the journal of the American Aircraft Owners and Pilots Association remarks, such a flight just thirty years ago sent the world into a frenzy of excitement.

The Association reports that a sampling of mail processed by its Flight and Travel Department in a recent six-month period showed that over fifty requests for help or information about transatlantic flying by small aircraft had been handled. The Association's records show that over fifty Piper Apaches have made the trip in the last two years, along with thirty or more Cessnas and various Beechcrafts, Aero Commanders and others. It is emphasized that such machines must have extra fuel tanks and that the pilot must have an instrument rating because one-third of the trip must sometimes be flown blind. Most crossings start at Gander and the 2,000-mile hop to Ireland means that sufficient fuel must be provided for a 3,000-mile range. The Association comments: "The first-time Atlantic flyer's greatest problem will be his own fears. Weather, navigation and terrain set few problems to the pilot over the ocean, but he needs experience to enable him to deal with the natural worries and fears likely to mar his efficiency when he has passed beyond the point of no return." As Max Conrad, who has ferried many small aircraft to Europe, remarks, "It has really gotten so that there is almost too much on the radio. You find yourself chatting halfway across the ocean. Everbody's friendly."

So while the big jets are screaming defiance one to another in the coming stratospheric battle for Atlantic supremacy, we in this country shall be keeping a quiet and envious eye on the gentlemen adventurers who proceed about their own transatlantic business—whether it be a routine hop across to Paris on a matter of merchandising, or the keeping of a rendezvous with those "natural worries and fears" that lie beyond the point of no return.

FROM THE ASHES: The scene in St. Clement Danes when, as related below, it was re-consecrated as the central church of the R.A.F. On the right, the Queen is received by Marshal of the Royal Air Force Sir Dermot Boyle, Chief of the Air Staff. Also seen are the Duke of Edinburgh, the Mayor of Westminster (Councillor David Cobbold) and the Air Minister, Mr. George Ward

FROM ALL QUARTERS

The Royal Air Force Church

THE historic Wren church of St. Clement Danes, London, bombed and burnt out in 1941 and now restored as the central church of the Royal Air Force and as a shrine of remembrance, was re-consecrated last Sunday by the Bishop of London, Dr. Montgomery Campbell, in the presence of the Queen. With Her Majesty was the Duke of Edinburgh, and six other members of the Royal Family were present: the Queen Mother, Princess Margaret, the Duke and Duchess of Gloucester, the Duchess of Kent and Princess Alexandra.

A strong sense of the linking of periods of history, the finely rendered choral music, the colours of the church interior and of the uniforms and decorations: all these made the occasion both moving and memorable. Seldom if ever can so many senior officers of the R.A.F., serving and retired, have been gathered in one place. There were the Members of the Air Council, headed by the Secretary of State for Air; three former Air Ministers; representatives of the Royal Navy; the C.I.G.S. and the Adjutant General from the Army; the Chief of the Air Staff and four other Marshals of the Royal Air Force; a score of retired air chief marshals; the A.O.C.s-in-C. of nearly every Command; and senior officers of the Commonwealth Air Forces.

In the course of his sermon the Archbishop of Canterbury, Dr. Fisher, spoke of the long history of St. Clement Danes, and went on to say:—

"How good it is, and how fitting, that the Royal Air Force should have St. Clement Danes to be the centre of its constant eucharist, its thanksgiving, its security in Christ, its unity in itself. Like all lovely things, this shrine will not ever make itself over-important or tyrannical. The church is always at your service, a witness and an effective sign of that simple faith which each member of the Royal Air Force must master for himself and seek ever to live by."

Every R.A.F. unit, at home and abroad, has contributed to the restoration, and Commonwealth and other air forces, together wth various organizations and individuals, have made generous gifts in cash or in kind. Artistic skill and fine craftsmanship have translated their generosity into something tangible, gracious and enduring; and of this the re-consecration ceremony, in the Queen's gracious presence, was a fitting realization. (*Notes on the restoration of the church appeared on p. 637 of "Flight" last week.*)

Bristol T.188

REFERENCE may now be made to what is obviously the most advanced aeroplane at present under development in Britain. Designated T.188, it is officially described as a stainless-steel supersonic research aircraft; and it has been designed by the Bristol Aeroplane Co., Ltd.

This is all that may be officially stated, but much may be conjectured. The English Electric Lightning is a Mach 2 fighter in being, and the Avro Aircraft Arrow is probably potentially faster still. It follows, therefore, that the T.188 must be designed for a Mach number of the order of 3, and the mention of stainless steel confirms this. Power could be provided by any combination of the following: Bristol Olympus BOl.7R; Rolls-Royce Conway with reheat; de Havilland Gyron Junior DGJ.10 with reheat; de Havilland Spectre; Bristol Thor or a later ramjet. The reheat Olympus and DGJ.10 are both known to be under development for a supersonic aircraft not yet named.

Although the T.188 is designed purely for research purposes, it may well be that it will have a configuration representing a scale model of a future transport; as things stand at present, there is no requirement for a supersonic military aeroplane beyond the Lightning, although it is possible that the much discussed OR.339 Canberra-replacement specification may call for a Mach number of T.188 level.

Britain Buys S.S.11s

A RUMOUR from France to the effect that the United Kingdom has purchased a number of Nord S.S.11 wire-guided anti-tank missiles has been confirmed by the Ministry of Supply. It is understood that a batch is to undergo trial firings against a variety of targets and air-launching will be carried out from Scottish Aviation Twin Pioneers and Prestwick Pioneers.

Recently the Ministry of Supply purchased a similar batch of Australian Malkara weapons for evaluation, and other missiles in the same category are being developed by Fairey Aviation (an official contract for the Army), Vickers-Armstrongs and Pye.

Tu-104 Disaster

THE first reported accident involving a Russian jet airliner occured on October 17, when an Aeroflot Tu-104 crashed while on a regular service from Peking to Moscow. The accident was at Kanash, about 400 miles east of Moscow and 150 miles south-east of Gorki. There were no survivors among the crew and 65 passengers on board (shown on the passenger list were 17 Chinese, four Germans, and one Briton). A Russian commission of inquiry at once left for the scene of the disaster.

Aeroflot's latest timetable shows a twice weekly service between Moscow and Peking, via Irkutsk and Omsk, on which Tu-104As are used. The Tu-104 service terminates at Irkutsk.

Caring for the Veterans

LAST week the Royal Aeronautical Society was able to give the good news that the problems associated with the maintenance of the Nash Collection of historic aircraft—which it acquired four years ago, and which may one day go into a national aeronautical museum—are much nearer solution.

Recently a hangar was made available at R.A.F. Station Hendon, and last July the Society appealed for suitably qualified volunteers to assist in maintenance. The volunteers will do the work in their spare time. Some are R.Ae.S. members; others are members of the Society of Licensed Aircraft Engineers. The R.Ae.S. says it is particularly grateful to the S.L.A.E. for its co-operation, especially as several of the helpers are engineers whose experience goes back to aeroplanes of 1910-1920 vintage.

The veterans are a 1910 Blériot XIa; 1911 Blériot XXVII; 1912 Caudron GIII; 1913 Farman F.40; two 1914 Avro 504s; 1917 Sopwith Camel; 1918 Fokker D VII; and 1918 S.E.5A. Of much younger vintage is a Wellington X, presented by Vickers-Armstrongs (Aircraft), Ltd., two years ago.

***HYPERSONIC:** The first X-15 research aircraft was unveiled on October 15 at the Los Angeles plant of North American Aviation. Powered by two four-barrel Reaction Motors LR99 rocket engines, the X-15 is to be air-launched from a B-52 early next year and will eventually exceed 3,600 m.p.h. at altitudes of some 100 miles*

About Blue Streak

ON October 16 the Ministry of Defence deemed it advisable to issue an official denial of a newspaper story to the effect that Blue Streak, the D.H. Propellers LRBM, was obsolescent or to be relegated to a research and training rôle. The official statement said "there has been no alteration in plans for its development as an operational weapon."

Supermarine Atomics

INDICATIVE of the steady "diversification" of the industry, the Vickers-Armstrongs Supermarine factory at South Marston, Wilts, has developed a nuclear section. It has already been decided that when current Scimitar contracts are phased out, in some eighteen months' time, Supermarine will cease to conduct major aircraft research and development; instead, this will be concentrated at Weybridge. Some hundred engineers are now engaged on nuclear work at South Marston and two experimental reactors are being made for the A.E.R.E., Harwell.

Advice for the Minister

A NEW committee has been formed to assist the Minister of Transport and Civil Aviation to keep in touch with the views of the private flying movement in the framing of civil aviation policy. Known as the Standing Joint Committee on Private and Club Flying and Gliding, the new group will consist of representatives from the Royal Aero Club, the Association of British Aero Clubs and Centres, the Popular Flying Association and the British Gliding Association, together with senior M.T.C.A. officials. The chairman of the committee will be Mr. Airey Neave, Joint Parliamentary Secretary to the Minister, and the secretary will be Mr. L. C. Nash. The first meeting is expected before the end of this month.

Eland-Convair in the U.S.

NAPIER have launched an intensive campaign to sell the Eland-Convair, particularly in the U.S. Sir Archibald Hope, a Napier director, revealed in Washington last week his company's plans for exploiting the large, untapped non-business travel market by making short-haul "air bus" transportation a reality.

The Eland conversion will cost about $400,000 and is expected to be carried out at Santa Monica, California. About one-half of the 350 Convair 340s and 440s in airline use throughout the world are to be found in the U.S.

Napier's demonstration 340 was unfortunately damaged on the day that the sales campaign moved under way. Leakage of hydraulic fluid after braking trials led to a fire. Tests will continue with a converted 440 while the aircraft is being repaired.

B.I.S. Quarter-Century

TWENTY-FIVE years' active interest in space travel were celebrated by the British Interplanetary Society at two London functions, respectively technical and social, last week. The first was a two-day symposium on space medicine (see p. 652), organized in conjunction with the R.A.F. Institute of Aviation Medicine; the second was an anniversary dinner at the Waldorf Hotel on Friday, October 17. A painting of the third Soviet satellite by Jack Wood was presented at the dinner to the founder of the Society, Mr. P. E. Cleator, by the present chairman, Dr. L. R. Shepherd.

Proposing the health of the Society, Dr. Shepherd read messages of congratulation from a large number of overseas astronautics associations, and disclosed that one-third of the B.I.S. members lived outside the United Kingdom. He traced the 25-year history of the Society which, he claimed, had taken a long time to become "generally regarded as respectable." Mr. P. E. Cleator replied to the toast.

After the health of the guests had been proposed by Mr. L. J. Carter, secretary of the Society, and the response made by Prof. H. S. W. Massey of University College, London, Cdr. G. Hoover, U.S.N., one of the symposium lecturers, proposed a toast to "The achievement of space-flight." In reply, Mr. W. H. Stephens, Deputy Director of R.A.E. Farnborough, reviewed achievements to date. Although the Skylark rocket was small in scale it had produced good results and, as Prof. Massey had pointed out, Pioneer had got within 400ft/sec of reaching the Moon—it was rather unfair to regard it as having achieved the greatest miss-distance of all time. The speaker hoped that the Society's 50th anniversary would honour the pioneers of manned space-flight—who would of course be B.I.S. members.

Hawker Siddeley Group Appointments

TWO senior executive appointments have been made in connection with the recently announced reorganization of the Hawker Siddeley Group into aviation and industrial divisions. Mr. William Humble, M.B.E., latterly Group regional executive for the Near East and Pakistan, has been appointed international sales manager of the aviation division; and Mr. Michael Clear, B.Sc., formerly Brush Group director of exports, becomes international sales manager of the industrial division (which, initially, will embrace the Group's electrical engineering and oil-engine interests).

"Bill" Humble has been well known in the aviation industry for many years as a test and racing pilot. He learned to fly in 1929, and after serving in the Auxiliary Air Force (with Nos. 504 and 609 Sqns.) went in 1940 to Hawker Aircraft, where, as chief test pilot, he was responsible for prototype testing of most of their famous war-time types. In 1948 he was appointed sales manager, and two years later went to his Near East post.

Mr. Clear, who has world-wide industrial sales experience, served in R.E.M.E. during the war, attaining the rank of lieutenant-colonel.

IN BRIEF

It is now permissible to divulge the thrust of three versions of the de Havilland Spectre rocket motor. The DSpe.1, 2 and 3 are all rated at 7,000 lb at sea level. Later versions of the Spectre are doubtless more powerful.

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Providing a stand-by-stand survey of the Motor Show at Earls Court, London, our associated journal *The Autocar* is publishing its Show Report Number today (October 24). The price of this greatly enlarged issue is 2s 6d.

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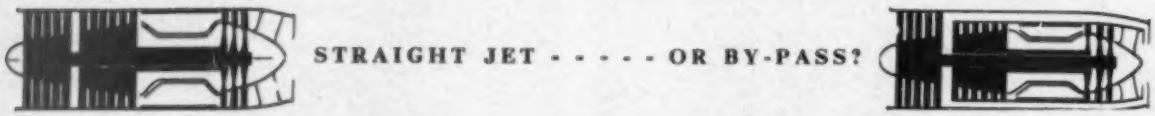
Two forthcoming memorial lectures to be given before R.Ae.S. branches, both on November 3, are: Third Henry Royce Lecture, *The Present and Future*, by A. Cdre F. R. Banks (Derby Branch); and Second Trenchard Lecture, *Operation Grapple*, by G/C. R. H. C. Brousson (Henlow Branch).

* * *

Orders to the value of over £4m are likely to be placed with British and U.S. manufacturers of constant-speed drives for the A.C. electrical equipment of the 400-odd airliners now on order and due for delivery beginning next year. This was stated last week by Mr. H. M. Sutcliffe, of English Electric's Aircraft equipment division, in a lecture before the Yorkshire Branch of the Graduate Section of the Institution of Mechanical Engineers. We hope to make further reference, next week, to Mr. Sutcliffe's paper.

***RECENTLY APPOINTED:** Mr. W. Strachan, general manager of the Weston division of Bristol Aircraft, becomes managing director of Bristol-Aerojet, Ltd., the new company whose formation was announced in these pages last week; and (right) Mr. H. Phillips, who comes from A. and A.E.E., Boscombe Down (with 2,400 hours' rotary-wing experience) to join the helicopter division of Saunders-Roe as a test pilot*

Power for the Short-range Jet



A STRONG case for the by-pass engine in transports of less than 1,000 miles' range was made by Mr. H. Pearson, B.A., M.I.Mech.E., F.R.Ae.S., and Mr. R. M. Fitzgerald, B.Sc., respectively chief research engineer and chief project assessment engineer of Rolls-Royce, Ltd., in a joint paper read recently in Brussels. They were addressing the third European Conference of the International Association of Aeronautical Equipment Manufacturers, and the title of their lecture was *Some Considerations Affecting the Design of Engines for Short-to-medium-range Airliners*. A summary follows.

Though a good deal of controversy has raged around the by-pass engine [the lecturers began], development has shown that there are real advantages. Competing manufacturers have been naturally critical and a vigorous campaign has been lodged against it. Nevertheless, if current proposals for the American ducted-fan engine turn out to be successful it will seem that the by-pass principle for subsonic aircraft has been generally acknowledged.

The by-pass ratio of an engine has been defined as the ratio of the air going round the engine to that entering the high-pressure compressor. Some prefer to express by-pass ratio as the ratio of air passing round the engine to that entering the l.p. compressor. The former expression has the virtue of opening the scale—i.e., an engine with a high by-pass ratio would have ratios of, say, 1.5 or over. With the latter definition a high ratio implies anything between about 0.5 and 0.8.

Initially the by-pass engine was conceived as operating with substantially the same high-pressure airflow as the comparatively simple jet engine, the extra by-pass airflow contributing to give a higher propulsive efficiency. The total airflow is, however, much greater, and a larger nacelle with higher installed drag has to be used. It is usual to operate the by-pass at higher temperature.

This picture of relative performance has been used to attack the by-pass; at low specific thrusts, as would be expected, its specific fuel consumption is superior, but at higher specific thrusts the inverse is true. It is claimed that installation considerations dictate that a specific thrust of 40-45 lb/lb weight is essential, under which conditions the specific consumption of the by-pass engine is actually higher than the simple jet. This point cannot be settled until the actual cases are investigated and nacelle drag is incorporated in the curves. However, if both engines are operated at the same specific thrust, the 0.4 by-pass ratio engine will be operating some 130 deg C hotter, and the specific consumption will be marginally worse. But the case cannot be left at this point, since the important qualities of an engine are (1) thrust, (2) specific fuel consumption, (3) installed weight, (4) bulk, (5) price and (6) the name of the manufacturer.

Comparing a simple jet with a by-pass engine of the same total airflow, the two l.p. compressors are the same size and pressure ratio, but the high-pressure compressor of the by-pass engine is much smaller; and so are the combustion chamber and high-pressure turbines. In fact, the whole high-pressure section of the by-pass engine is an area scale-down of that of the simple jet engine, in the ratios of the quantity

$$\frac{1}{1 + \text{by-pass ratio}}$$

The by-pass l.p. turbine is somewhat bigger, owing to the fact that a greater work output is derived from it; but there is not much difference in weight. Comparative weights are shown in Fig. 2; installation weights are even more favourable to the by-pass.

For the type of mission in which we are interested the engine weight is about one-third to one-quarter as important as specific fuel-consumption. Therefore the difference of 17 per cent in engine weight is worth about 4 to 6 per cent improvement in fuel consumption, and at a specific thrust of 40 there is only 1½ per cent difference in fuel consumption. On this rough computation, therefore, the by-pass engine shows up well.

By correct choice of the best specific thrust for each type for a long- or short-range mission the by-pass engine has an advantage of some 3 to 4 per cent (Fig. 3)—a very worthwhile gain.

When comparison between by-pass and plain jet is made on a true basis, there is some 3 to 5 per cent advantage with the by-pass engine. Clearly one manufacturer may be cleverer than another and achieve a better result with an inferior basic design, but this comparison is to be taken between two engines of equivalent component efficiency and design skill.

So far it has been assumed that, in effect, the by-pass and exhaust jets are discharged separately and that their velocities are arranged to give the maximum thrust. For this purpose, if the component efficiencies were 100 per cent the two streams would be arranged to give the same jet velocity. Under actual conditions the by-pass jet velocity is less than that of the exhaust.

In many cases it is convenient to take the by-pass stream back into the jet-pipe, and a certain amount of mixing occurs. For the pressures in the by-pass and exhaust stream chosen to fulfil the conditions above, substantially the same results are obtained and the mixing process has little effect on the performance.

When demands for thrust reversal on landing and possible silencing of jets are considered, the desirability of uniting the two jets is obvious. It is imperative to mix under the optimum conditions, in order to minimize losses as much as possible and, if possible, to derive some benefit from the mixing process. It is clear that the mixing velocities should be kept low and that differential velocities should be kept to the minimum.

To be consistent with the above conditions the total pressure in jet-pipe and by-pass streams must be approximately the same, a very different condition from that for the optimum for separate jets. Under these conditions it is found that a substantial gain in performance is obtained from mixing; the higher the by-pass ratio the greater the gain.

Provision of such a mixing arrangement naturally involves some increase in weight, and some losses in friction, but calculations show that an appreciable improvement in performance does result. Allowing for efficient mixing, the reduction in engine plus fuel weight is nearly doubled for a 0.4 by-pass engine in comparison with the simple jet. This is a notable example of the development capability of this type of engine and future by-pass engines will make use of this process.

The provision for efficient mixing involves more than that of a special jet-pipe and "daisy" mixer. Because of the conditions for equal total head in by-pass and exhaust a much lower compression ratio of the l.p. compressor has to be chosen than in the case of separate jets. As an example, an l.p. ratio of about 3.5 for separate jets must be reduced to about 2.2 for efficient mixing.

Fig. 1. Comparison of a pure jet and two by-pass engines of 0.4 and 1.0 by-pass ratio

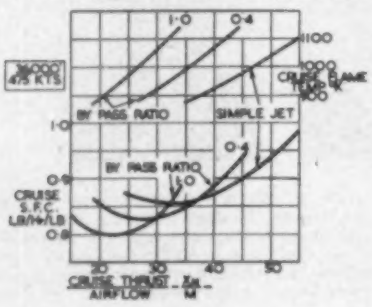


Fig. 2. Comparison of a simple jet and by-pass of the same airflow

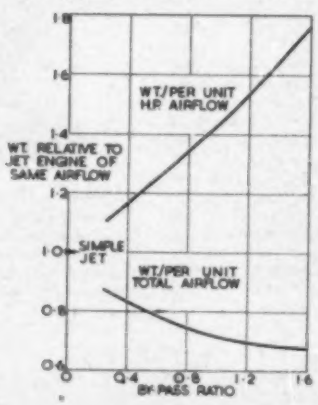
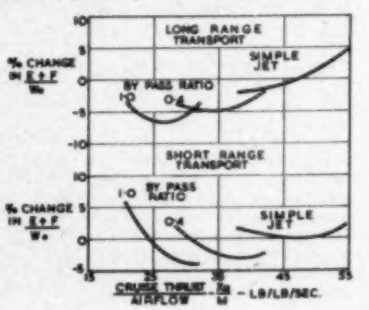


Fig. 3. Comparative weights of a simple jet and a by-pass engine at 36,000ft and 457 kt



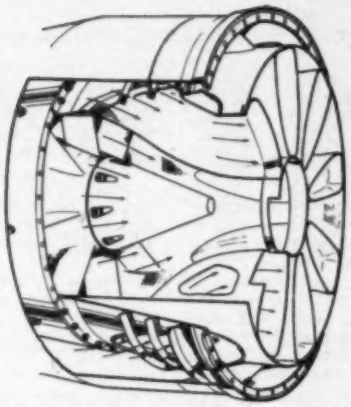


Fig. 4. The jet mixer of the Rolls-Royce RB.141 is intended to mix by-pass and jet flows in a short length at low differential velocities

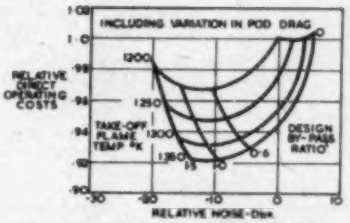


Fig. 5. Variation of the direct operating cost of a short-range jet transport and noise at climb-away. The datum for comparison is a simple jet at 1,200 deg K take-off flame-temperature

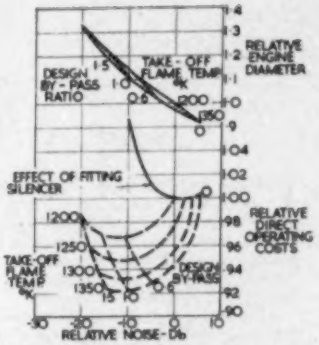


Fig. 6. This diagram shows the relationship between noise-level and engine diameter and the effect on direct operating cost of silencing a simple jet engine

It is clear from the foregoing [continued the lecturers] that we consider the ideal for the stated purpose to be a by-pass engine. It remains to settle its main specification, i.e., temperature, by-pass ratio, pressure ratio, etc.

For the type of aircraft required what is wanted is a speed of about 600 m.p.h. at 25,000ft, a design full-payload range of about 850 miles (with good performance over 200-mile stage-lengths) and a capacity payload of about 20,000 lb (80 to 100 passengers). Fuel reserves cater for 150 n.m. diversion to alternate, and 45 minutes' holding at 5,000ft.

The size of pod—which governs the drag—required to house a particular engine is determined by: (1) required drag-rise Mach number, (2) engine-intake airflow, and (3) engine dimensions.

For a high-subsonic cruising speed it is usually found that satisfying requirements (1) and (2) provides sufficient volume for item (3). From the many engine installations studied at Rolls-Royce a figure of 1 sq ft of pod frontal area per 13.3 lb/sec of engine take-off airflow (including interference) and a drag coefficient of 0.08 have been found a fair average.

Calculations for engines of both by-pass and plain jet types show that, even allowing for the greater weight of high-pressure-ratio engines, it nevertheless pays to design the pressure ratio as high as possible, provided that the turbine entry temperature is not too low. A ratio as high as possible is therefore chosen, restricted by mechanical and technical feasibility to about 13. There are no reasons for choosing it very different for either type at the design point in these calculations. Relative to this design point the take-off condition is taken as 2½ per cent overspeed, i.e., a 5 per cent increase in turbine entry temperature.

Variation in entry temperature does not materially affect the performance of a plain-jet aircraft. The slight improvement with temperature is due to the reduction in pod size, which reduces the pod drag. For by-pass engines it pays to design for a high entry temperature, but at any comparative value the payload capacity of the aircraft is improved. Generally speaking, the best performance is obtained at a by-pass ratio of between 0.6 and 1.0, depending on the turbine temperature.

The gain for a temperature of 1,250 deg K is nearly 4 per cent in payload, or for the same payload an aircraft in the 100,000 lb a.u.w. range could be designed 4,000 lb lighter.

The fact is most useful and shows that by development of an existing engine, i.e., by increasing temperature, aircraft performance will continuously improve. For a simple jet engine there would be no significant change in basic performance.

The gains in payload with increasing temperature are not solely due to a reduction in engine size and weight. Although the fuel per unit all-up weight increases with increase of temperature, the payload increases faster, so that the fuel as a percentage of payload is actually reduced and—an important point—there is a most marked reduction in fuel used with increase in by-pass ratio.

It is often stated that the by-pass engine will be quieter than the plain jet. This is not inherently true, because noise depends almost entirely on specific thrust (i.e., jet velocity), and either type of engine can be designed at any value of specific thrust. For a given take-off thrust the only way to achieve a quieter engine, without deliberate silencing, is by fitting larger engines and therefore increasing the installed drag. Increasing temperature makes the noise greater, while at fixed temperature increasing the by-pass ratio reduces the noise.

Fig. 5 might be considered the final summary of this investigation, in which relative direct operating costs are plotted against relative noise-level. The gains in operating costs are illustrated against the possible reduction in noise. With a plain-jet engine reduction of turbine entry temperature has little or no effect on operating costs but can result in a 5 decibel drop in noise. With a by-pass engine it is possible, by designing for a take-off temperature of 1,300 deg K, to obtain a reduction of nearly 7 per cent in operating costs and a 10 db reduction in noise level. By-pass ratios higher than 0.6 are not otherwise justifiable on a cost basis.

Noise-level is almost uniquely fixed by diameter (Fig. 6). If noise to a predetermined level is a requirement, the effect on the direct operating costs of silencing a simple jet engine has been assessed; the increase in cost is due to the weight of silencer, the loss in thrust, additional external drag and increase in specific fuel consumption. It will be seen that to achieve the same noise-level as the by-pass engine leads to higher operating costs.

The remainder of Messrs. Pearson and Fitzgerald's lecture was devoted to a consideration of the various conditions which aircraft engines may encounter:—

De-icing. The critical design condition is the descent through a de-icing layer with engines throttled back. On an engine such as the one under discussion, at the engine speed necessary in a descent condition approximately 4 per cent of the engine air will have to be bled back for de-icing. This loss of air bleed would be very serious at higher engine speeds and a multi-position valve is placed in the duct line so that the amount of air bled off is cut down with increase r.p.m.

Uneven Air Distribution. A sudden change of attitude of the aircraft, or the encountering of a gust, may give such an incidence on to the air intake that the engine will be fed with an uneven air velocity distribution round its entry face. This could lead to surging of the compressor and possible extinction of the engine, or it may excite resonant vibrations in the compressor blades, leading to blade failure.

The possibility of resonant excitation of early-stage rotor blades is governed by the blade frequencies coinciding with multiples of the engine revolution frequency, and Rolls-Royce design to avoid resonances with such engine orders in the upper speed range.

Blade Vulnerability. This is closely allied to the material of which the early-stage compressor blades are made.

Aluminium blades (as employed by Rolls-Royce) are chosen in order to reduce engine weight. It is argued that damage from ice and runway debris will have a greater effect on aluminium than steel blades. There was encouragement to persevere with aluminium because, if compressor blades occasionally fail either from damage or through fatigue, it is easier to retain aluminium blades within the engine casing. With early-stage blading made from steel this is a very stringent condition for the casings to withstand. Sharp-edged dents and fatigue damage are also less likely on aluminium blades. Otherwise there seems little to choose between the two materials.

Turbine-disc Integrity. The possibility of a disc failure in service may or may not cause the airline passenger much disquiet, but it is a real nightmare to the engine manufacturer.

However careful he may be, one day a turbine disc could burst and the damage wreck the aircraft. Thus some protective armour forming part of the casing should be placed around the engine to ensure that the complete disc will be retained. This will be very heavy, but experiments are proceeding to investigate the design of such guards.

Turbine discs will fail either from creep due to steady stress or from fatigue caused by the direct disc-stresses being applied cyclically every time the engine speed is changed, or (more probably) from fatigue due to vibration stress being set up in the disc by stationary disturbances in the gas flow condition around the turbine annulus. While not being normally present in the engine operation these might be caused by the extinction of one combustion chamber owing to a faulty burner, or by possible damage to one or more turbine nozzle vanes. The gas-flow irregularities lead to axial forces on the blades and disc which may set up a stationary disc-vibration, possibly leading to rapid failure.

Taking these three possibilities, disc creep is adequately tested by long-term testing at the highest temperatures and speeds to which the engine is subjected. If air-cooled discs are used it then becomes imperative that the disc cooling system should not fail, or that adequate indication of this should be given.

The possibility of excitation of standing waves in the disc cannot be avoided completely. However, it is found that in some of the many modes maximum stresses are much higher in blades than discs. In these circumstances the excitation will lead to a failure of the blades, which the engine will retain.

Thus the problem of disc failure is one of designing only those modes which would lead to disc failures, outside the engine speed range. In this way a major contribution to aircraft safety has been made.

Man in Space

SOME OF THE MANY PROBLEMS LIKELY TO BE ON HIS MIND

IN the stage of space exploration beyond the present era of unmanned rockets, satellites and lunar probes, man is himself the limiting factor and the space vehicle must be built around him. This basic fact was a dominant theme at the symposium on space medicine organized in London last week by the British Interplanetary Society in conjunction with the R.A.F. Institute of Aviation Medicine.

This theme was put forward early on the first day of the meeting, October 16, by DR. G. PUGH of the Medical Research Council's Division of Human Physiology in a paper entitled *The Effects of Altitude on Consciousness*. By conditioning men to work in a low atmospheric pressure, and to exist on, say, 1,000 calories per day instead of 2,500, a considerable saving in the weight of food, water and oxygen equipment needed in a space-ship (for a six-day journey to and from the Moon) could be made. The speaker doubted the wisdom of this economy.

Dr. Pugh, who has himself carried out nutritional and endurance tests in Antarctica and the Himalayas, said that a refusal to recognize physiological limitations, in the overriding wish to save weight, had delayed the climbing of Everest for 30 years. Interplanetary voyages should not be attempted until these human problems had been solved.

An ambitious presentation which developed the basic theme of the relationship between man and machines that afternoon was *The Man-Machine System in Space Vehicles* by CDR. G. W. HOOVER, U.S.N., Weapons System Manager, Air Branch, U.S. Office of Naval Research. Man's rôle was essentially decision-making; his own natural environment was the one in which he operated best; therefore his natural environment should be maintained as closely as possible within his vehicle.

"When man moves into space," Cdr. Hoover continued, "there can be no compromises such as have been permitted in aircraft and submarines, where the operators are forced to work at their maximum efficiency in order to make up for the inadequacy of equipment design.

"If man is to go into space we must now begin to place more emphasis on the consideration of man's environment and capabilities, or at least as much as we place on the machine itself. When we study the problems of the vehicle we spare no expenses in studies and experiments to wring the last ounce of performance from its design capabilities. We must therefore spare no expense in establishing those conditions necessary for providing an environment in which we can get maximum performance from the man."

A space-ship could be considered as two sections: the man-machine loop or "brain," and the machine itself or "muscle." The design of the machine—its structure, materials, powerplant and payload—must be determined by the needs of the man-machine loop. The man's requirements were for information and, physiologically and psychologically, for a suitable environment. Among the physical factors were pressurization, ventilation, atmospheric composition, humidity, temperature, acceleration, vibration, noise, illumination, and radiation; and metabolic requirements to be determined included food, water, waste disposal and work/rest cycle. The objective of the psychological studies was to define factors which keep man mentally stable in order to function efficiently in the total system, and the first step was to maintain minimum emotional stress, maximum morale, sufficient relaxation and adequate habitability.

An Integrated Programme

As a practical example of the concept and method of integrating man and machine, Cdr. Hoover showed an exceptionally interesting colour film of the Army-Navy Instrumentation Programme, a U.S. project initiated by the Office of Naval Research and the Bureau of Aeronautics and aimed at the development of an integrated presentation of flight data. This programme embodied optimum presentation and control for a man-machine system and was applicable not only to aircraft but to all vehicles.

A panel discussion of Cdr. Hoover's paper followed, by members of the O.N.R. team who included MR. A. MAYO of Douglas Aircraft, DR. H. E. SHEETS of the Electric Boat Company, and MR. O. Q. NIEHAUS of Bell Helicopter Corporation. Could reliance be placed on a human in control of a space-ship, they were asked. The answer was that a completely automatic system, including a decision-making computer, *could* be employed, but the machine would not have the ability to change its mind on the basis of unexpected information.

The remaining five papers presented on the first day of the meeting dealt with human performance under specific conditions. In *Some Consequences of Weightlessness and Artificial Weight*, DR. M. P. LANSBERG of the Netherlands National Aeromedical Centre, Soesterberg, warned against placing too much significance on the sensations of weightlessness achieved to date by short parabolic flight-paths as an indication of true space-flight. S/L. T. C. D. WHITESIDE of the R.A.F. Institute of Aviation Medicine agreed with this, and suggested that motion sickness was going to be the key problem, in a paper titled *Vision and Orientation at Extreme Altitudes*.

Two other I.A.M. representatives gave results of particular investigations. F/L. J. C. GUIGNARD spoke on *The Physiological Effects of Transient Mechanical Forces: a Review of their Relevance to Astronautics*, showing diagrams of the limits of human tolerance to acceleration (man can accept more transverse g than positive g, and more positive g than negative g); and of the effects of vibration as functions of frequency. In his paper *Impairment of Human Performance in Control*, DR. K. F. JACKSON described one experiment in which the efficiency of pilots of long-range maritime aircraft was studied during long flights; and another in which the ability to deal with several control situations simultaneously was investigated.

An Air Ministry psychologist, MR. CYRIL CUNNINGHAM, discussed *The Effects of Sensory Impoverishment, Confinement and Sleep Deprivation*, quoting evidence to show that there was a level of sensory deprivation below which the consequences could be psychologically serious. This level depended (a) upon the individual and (b) on his rôle—passive or active, and it could be raised by careful personnel selection, familiarity with environment and with one's own reactions.

Temperature and Radiation

Space-flight hazards likely to be caused by acceleration, high and low temperatures, explosive decompression and radiation were among the topics discussed on the second day of the symposium. *Effects of Prolonged Exposure to Positive g loadings on the Pulmonary Gas Exchange* was the opening subject chosen by DR. H. BJURSTEDT of the Laboratory of Aviation and Naval Medicine, Stockholm, who suggested a combined psycho-physiological approach to performance problems resulting from accelerative stress (g x time).

Two papers by F/L. J. BILLINGHAM of the R.A.F. Institute of Aviation Medicine concerned the thermal environment of space travellers. In *Man's Thermal Environment during Interplanetary Travel* he analysed the heat exchange between man and his immediate surroundings in a sealed cabin during prolonged interplanetary travel and, in general terms, for the case of aerodynamic heating during re-entry. His second paper, *Heat Exchange between Man and his Environment on the Surface of the Moon*, concluded that the ideal surface of a full pressure suit would consist of three layers of aluminium foil with a spacer fabric between the inner layers. A cooling system would be needed and the coolant could be gaseous oxygen or a liquid.

Rabbits, rats and guinea pigs had been exposed to blast waves by scientists of the Research Institute of National Defence, Stockholm, declared DR. C. J. CLEMEDSON in his paper *Some Blast Studies with Application to Explosive Decompression*. The object was to study the effects of shockwaves on the physiological functions of the body. Similarities and differences between the effects of blast and of explosive decompression (of interest to crews whose space-ships are holed by meteorites) were described in considerable medical detail in Dr. Clemedson's paper.

A phenomenon described as probably the greatest medical hazard to space-flight yet discovered was discussed by DR. A. E. SLATER of the British Interplanetary Society in a talk on *Hazards of the Radiation Belt revealed by the Explorer Satellites*. This belt extended upwards from about 600 miles above the Earth and laterally from 30 deg N to 30 deg S (geomagnetic).

Information from the early satellites showed that the radiation experienced was over 1,000 times as intense as cosmic radiation. Crew protection and/or diversion of track would be essential in journeys to the Moon. Every 18 years, however, the "direct" path to the Moon would not pass through the radiation belt.

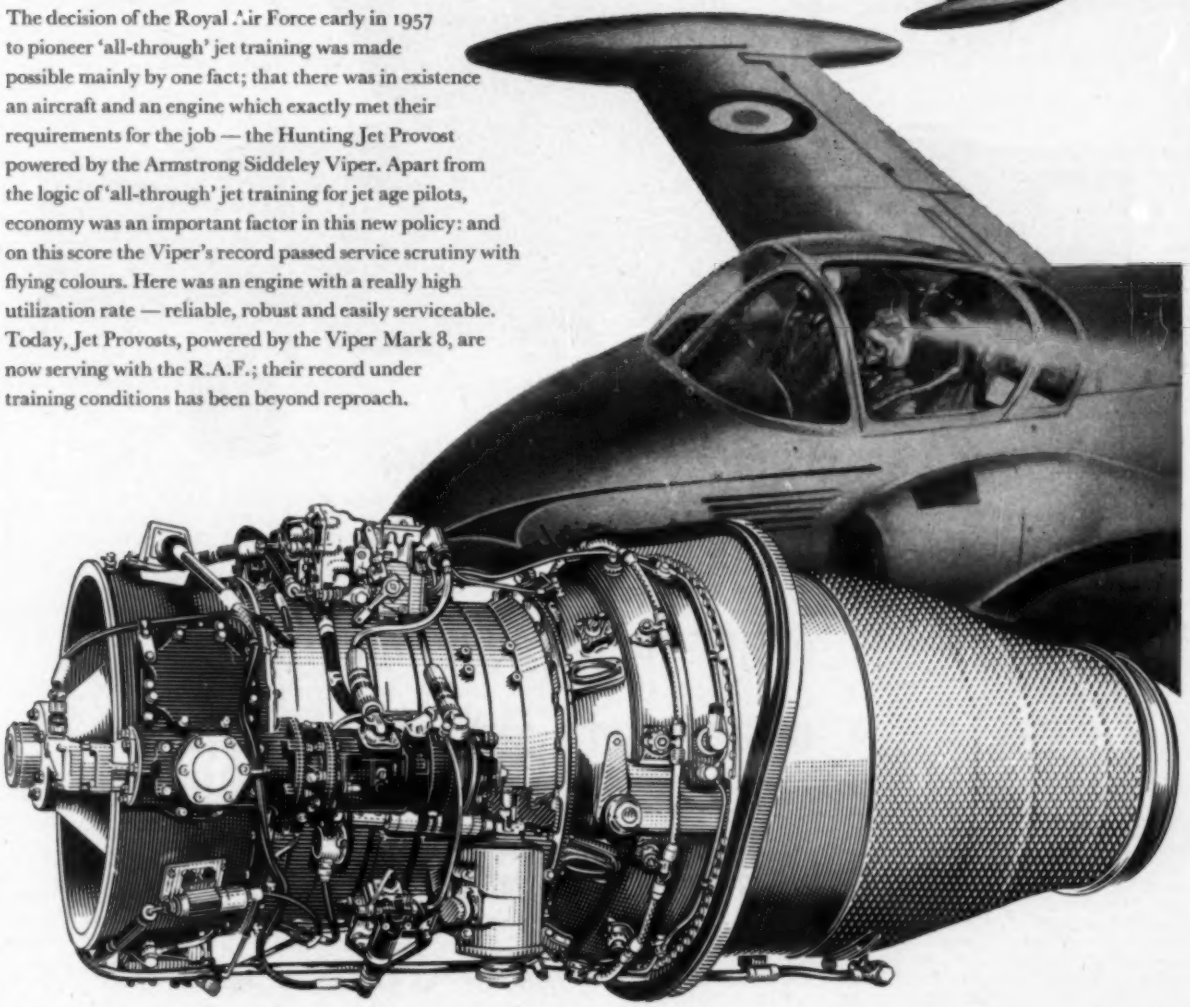
According to DR. A. S. PARKES and DR. AUDREY U. SMITH, of the National Institute for Medical Research, Mill Hill, the prospect of suspending animation in man by freezing him for indefinite periods is remote. This reassuring thought was contained in their paper, *Space Transport of Life in the Dried or Frozen State*, which pointed out that man is a warm-blooded vertebrate animal and therefore different, freezewise, from intertidal molluscs and Alaskan and Siberian insects. If he *were* dried and/or frozen and sent up in a space-ship, however, he would be able to withstand acceleration very well—*provided he was well packed to prevent breakage*. As for feeding the brute (the warm-blooded vertebrate brute), this question was effectively discussed by MR. S. W. F. HANSON of the Ministry of Agriculture, Fisheries and Food. in the paper *Some Problems of Space-flight Feeding*. Space-flight feeding, Mr. Hanson concluded, had some pretty big problems.

K. T. O.

VIPER

POWERS WORLD'S FIRST ALL-THROUGH JET TRAINER THE **HUNTING PROVOST**

The decision of the Royal Air Force early in 1957 to pioneer 'all-through' jet training was made possible mainly by one fact; that there was in existence an aircraft and an engine which exactly met their requirements for the job — the Hunting Jet Provost powered by the Armstrong Siddeley Viper. Apart from the logic of 'all-through' jet training for jet age pilots, economy was an important factor in this new policy: and on this score the Viper's record passed service scrutiny with flying colours. Here was an engine with a really high utilization rate — reliable, robust and easily serviceable. Today, Jet Provosts, powered by the Viper Mark 8, are now serving with the R.A.F.; their record under training conditions has been beyond reproach.



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Concrete Considerations

An Airline Pilot Discusses a Problem Confronting the Airlines on the Eastern Routes

By NEIL COLLEN

THAT clarion call "the mails must go through" is not heard on an air route. The fact remains that the airlines do make superhuman efforts to keep their services going, and deserve tremendous credit for maintaining services during such times of crisis as we have recently endured in the Middle East.

At the time of Suez a captain was heard to say: "It's been quite a trip. We had to divert from Singapore because of riots, and from Hong Kong because of a typhoon. We had some bits of unserviceability, and an engine failure, and on the ocean crossing to Ceylon a passenger went mad. We scraped out of Bahrein by the light of burning buildings, and had to divert to Istanbul without full map coverage. There were so many aircraft there that we could only uplift enough fuel for Athens. Leaving for Rome we hit turbulence, and had a lightning-strike. All in all, Cecil B. de Mille couldn't have done it better."

Few Tokyo services are normally so full of incident, but the fact remains that airline flying has not sunk to that low level of dreary routine that some predicted it would by the late 1950s. There are riots and wars which call for improvization even when other aspects of flying are uneventful, and there are many other problems to keep life interesting.

Next year, when the heavy jets come into operation, we shall have a new series of problems to face. Heavy jets are not different from other airliners; they are just more so. They are faster, heavier, more critical, more difficult to handle on the ground; they present a challenge. The first airline which will have to face that challenge on the Eastern routes appears to be Qantas, due to put Boeings into service next year. They have recently had a team investigating the problems of the route. Let us travel over the same ground.

Runways. It is popularly believed that for take-off on the Atlantic crossing even the runways at London Airport are shorter than Boeings would like. Another 2,000ft is talked about. Out East the sectors are shorter, and there are different aspects. All the same, some runways, such as Colombo, Djakarta, even Karachi and Calcutta, must look disconcertingly short. The problem requires serious and urgent attention. Runways that are just long enough to satisfy the C.A.R. field-length figures are not really good enough. For really safe operation much greater margins are required. There should be really safe undershoot areas to cope wtih slight misjudgements on the approach. There should be new overshoot areas, because those which were adequate for a Dakota will result in catastrophe if used by a heavy jet. As for the runways themselves, they must be adequate for accelerate-stops or over-fast landings even when they are damp, their surfaces greasy or slippery.

Slippery runways have been in the news, even with the propeller aircraft at present in service. An accident a few months ago in this country was partly blamed on skidding. There have been reports of slippery conditions at the two newest runways in British Africa, Nairobi and Salisbury. Certainly every pilot is familiar with this sort of entry on his briefing sheet: "Braking action extremely poor during light rain. Exercise extreme caution on landing."

One hears that even pilots of Britannias, which have fully reversing propellers, have had awkward moments in this connection. The landing-field lengths for the Boeing and the DC-8 are usually quoted as being about 3,000ft more than for the Britannia 310; no other figure can draw greater attention to the need for long runways. As for the Russian jets, some of them have been quoted as having V_2 speeds exceeding 150 kt and it is quite feasible that we shall be seeing some of these aircraft on the routes under discussion.

Bearing Strengths. Khartoum (in heading picture) was closed for repairs some months ago, and Wadi Seidna was put into use instead. After a few weeks the parking area began to break up; then soft patches showed in the main runway. While these were being treated some aircraft were having to land at night on a runway only effectively 80ft wide—half their wing-span. Recently the situation worsened. Some aircraft had to overfly; and there were cases of wheels breaking several inches through the surface.

This typifies what happens when aircraft with heavy wheel-loadings use anything but high-quality surfaces. Reports have come in from many other airfields. The civil airport of Ratmalana, Colombo, has virtually been abandoned by heavies. At Calcutta the main runway has had to be repaired. Parking areas have given trouble at Damascus, and even at London Airport. And there is always the chance that serious damage may result, as happened at Bombay when a B.O.A.C. Britannia went right through a runway shoulder.

The aircraft experiencing the most trouble have been Super Constellations and Britannia 102s. Yet even the Britannia 320 has a maximum weight of only 180,000 lb. From a recent copy of *Flight* we can see the following figures for the coming jets: Boeing 720, 203,000 lb; Boeing 707-220, 248,000 lb; Boeing 707-320, 296,000 lb; DC-8, between 265,000 lb and 310,000 lb; VC.10, 299,000 lb. We can safely assume that the wheel-loadings will be greater than those of present types. The big jets will be handicapped by the fact that they will be able to land only at high-quality airfields, and that in some cases there will be no diversion field capable of accepting them. This may be the case at Darwin, where a new runway has been built, but where there is no comparably good one within a thousand miles. It is hoped that the VC.10, which is very sensibly being designed to overcome the performance limitations already mentioned, will not be too restricted in this respect. The problem of bearing strengths extends to aprons and taxi-ways, so that it is not surprising to hear the cynics say that the only way to make money in aviation is to invest in concrete mixers. The cost of building a jet runway, level, long enough and strong enough, is enormous; one has recently been built at Kai Tak, Hong Kong, and perhaps we shall hear just what it cost [£6½m has been mentioned—Ed.]. It should cost less at most other places. Unless money is spent, however, all the plans of our airlines might as well be torn up.

Airfields. The fact that one airfield or airport is more critical than another does not necessarily mean that more accidents will occur. For example, Kai Tak has been infinitely more critical than London Airport, yet its accident record has been remarkably good. This is because higher minima have been used, while pilots and controllers have keyed themselves up to a higher degree. At a fully equipped airport, and in reasonable weather, the new jets should be just as safe as Connies or even Dakotas. Unfortunately, the majority of airports are far from being fully equipped. There are still international airports where the lighting is by goose-necks or little better, liable to be blown out by the blast of a machine taking off. There are many where the aids have not improved in years, where the radio range is bent, the I.L.S. usually out of action, and always unreliable in bad weather. When the writer was letting down recently at an international airport near which are high mountains, the M.F. beacons failed. In a more critical aircraft the experience might have been serious. It is little use sneering at the countries where this sort of thing happens; some of them can ill afford the concrete and aids required by a modern airliner.

This problem, again, must be faced realistically; there is an urgent need for reliable, foolproof aids. We need better lighting and high-quality approach lights and runway lights; and bearing in mind the characteristics of the coming aircraft we would welcome attitude-indicator lights some miles beyond the runway. We must have safe let-down aids, and stand-by electrical supplies. And we want them not just at the London Airports of the world, but everywhere these heavy jets may land.

Terminals. *"Are we not all familiar with the layout of an international airport? As we emerge from the aircraft we see a lofty structure wrapped in scaffolding. Then the air hostess leads us into a hut with an asbestos roof. Nor do we suppose it will ever be otherwise. By the time the building is complete the airfield will have moved to another site."* [continued overleaf

CONCRETE CONSIDERATIONS . . .

That not unjust layman's view of a terminal is attributed to Professor Parkinson, of Parkinson's Law fame. In the leisurely days one could get by with that sort of airport. But future aircraft will need reasonably efficient terminal buildings, capable of offering rest and restaurant facilities to passengers not by the score but by the hundred. Terminal areas will have to be large, to allow for the turning circles of the aircraft, and to make room for the attendant paraphernalia.

Not only will there be bigger loads to be handled. There will be a demand for them to be handled more quickly. The break-even utilization figure for the Boeing has been quoted as 9.6 hr a day. Certainly very high utilization-rates will be aimed at. Partly because of this there are demands for special handling equipment, super servicing-trolleys, special toilet and catering devices; perhaps pantechnicons which will tow, provide starting power, ground conditioning and the rest. Ruritania, whose only industry is making wine casks, has always done what it can to prevent the importation by airlines of even aircraft steps. Many operators must already be getting headaches at the prospects in store when they have to import into Ruritania (and other countries) some of the complex gear which will be necessary in the future.

And to speed transits there will be a call for high refuelling-rates. A figure of 1,200 gallons a minute has been mentioned. Enough for twice round the world in a small car—and put into an airliner in one minute. Every minute one of the new jets wastes on the ground may be worth pounds, so everything must be geared to quick transits.

With this in view airlines are already devising schemes to co-ordinate engineering, loading, catering, operational and traffic handling. There are schemes with signal lights at the aircraft; co-ordination officers (colloquially, "ring-masters"); talk of having mobile offices on the tarmac, parked alongside the aircraft. What of the passengers themselves? Here we have yet another difficulty.

The American M.A.T.S. found some time ago in Korea that to load 130 troops and their baggage into a Globemaster took 2½ hr. That seems a long time, and airlines could undoubtedly do better. But there is always a small percentage of "difficult" passengers—the invalid, the senile, the forgetful, the merely cussed. The more passengers on board, the more certain there will be one of these who will hold up everyone. An airline recently had a passenger arrive in the tourist cabin of the aircraft carrying a double-bass, which he stoutly contended was "permissible hand baggage" (even against the assertions of the crew that he was trying a big fiddle). Many old-fashioned aircraft—Solents, Yorks, even Skymasters—have odd corners for that sort of thing; but a feature of the coming jets is that every spare corner is occupied. Six-abreast seating means not just less elbow room, but less baggage space for everyone. Nevertheless, passengers will have to fit themselves in—and quickly.

Route Facilities. The airlines which have pioneered jet aircraft have not found any insuperable navigation problems. But air traffic control is likely to provide many headaches once a variety of jets starts to operate in the upper flight levels. Such separation as is at present achieved is obtained by means more related to the railway age than to the jet age. In some cases, separation of an incoming and an outgoing aircraft can be achieved only by sending one of them on a reciprocal for as long as is thought advisable, or keeping the outgoing aircraft at circuit height for some time. These quaint methods will have to be replaced by something better. And in order to assist control, point-to-point communications will have to be improved beyond recognition.

Conclusion. The writer does not want to be judged a prophet of doom. He himself hopes to take a rewarding piloting part in the jet era, which he sees as a time of challenge and success. But it is no use giving aviation problems the "ignore it, perhaps it won't happen" treatment. The memorable success of British operators in putting the first jet airliners into service has been due to their bold and realistic attitude. But at present there is a feeling among pilots (and even, one hears, among insurance experts) that some problems are not being frankly faced. Well, we shall soon see.

CRANFIELD'S OPEN DAYS

THE varied work and facilities of the College of Aeronautics, Cranfield, were on show to invited guests and the general public at Open Days on October 10 and 11—at the end of the first week of the 1958-59 academic year. Current developments, visible and not yet visible, included new installations and equipment in many Departments, and the imminent addition to the College's aircraft fleet of a Morane-Saulnier MS.760 Paris.

Among the aircraft in the Design Department's demonstration hangar were two which had not been seen publicly before—the Vickers Supermarine 545 and an anonymous high-wing machine which was obviously a flying-bomb type of missile (illustrated on p. 611 of *Flight* last week) Other Design exhibits of particular interest were the Department's second-year student projects for the last ten years; a comprehensive collection of missile models; a rotating-floor drop-test rig; and a vibration model of the Saunders-Roe P.531 helicopter used for ground-resonance studies.

Thesis work on the aerodynamics of swept wings is carried out at Cranfield with the aid of this Anson-mounted glass-fibre model which carries 39 pressure-plotting holes

The Department of Flight showed its varied fleet of aircraft, from the Dayglo-tipped Aiglet to Lancaster PA474 with half a Folland Midge wing mounted in its back. A glass-fibre swept-wing model was similarly carried by Anson G-AIPC: other aircraft included the Dove flying laboratory G-ALVF, Short Sherpa G-36-1, and a Swift F.3 used for ground demonstration.

Investigations in no fewer than 15 wind-tunnel installations were shown by the Aerodynamics Department. These included a 6in×4in intermittent supersonic blow-down tunnel (M=1.4-3.5), completed last June; 9in×9in continuous supersonic tunnel (M=1.5-2.8), with new centrifugal compressor just completed, giving a 4.8 pressure ratio; 8ft×6ft low-speed tunnel, in which automatic speed control has just been installed; a 2in-diameter pilot shock-tube and 7in×5in Freon-12 high-speed tunnel.

A newly established high-precision machine tools laboratory was open in the temperature-controlled metrology building of the Department of Economics and Production. Rocket and other powerplant demonstrations were held in the Propulsion Department's test area, and a variety of other specialist activity was displayed by the Departments of Electrical Engineering, Aircraft Materials, and Mathematics, and by the Work Study School. On Saturday, October 11, when the College was open to the general public, a flying display was held in the afternoon.

NEW CROP-SPRAYING SYSTEM

AN attractive new crop-spraying installation for light aircraft has recently been developed by Agricultural Aviation Co., Ltd., of Panshanger Aerodrome, Hertford. The system is being fitted to the de Havilland Chipmunk 23 agricultural aircraft, which is shortly to be flown on a world demonstration tour.

The primary unit of the system is the Agavco centrifugal pump, which incorporates two outlet pipes and delivers 120 gal/min at 3,000 r.p.m. and 60 lb/sq in. Weight of the unit is only 16½ lb. With the pump are associated spray-booms fitted with special "Jet-Spray" nozzles. The booms are manufactured in lengths to fit all types of light aircraft, and a universal mounting has been devised which fits any two-spar light-aircraft wing.

Having experienced an extremely busy U.K. spraying season this year, Agricultural Aviation are currently expanding both aircraft fleet and ground facilities at their new base at Panshanger. One important development is to be the establishment of a training school for agricultural pilots and ground personnel. This, it is hoped, will help to reduce the accident rate on this type of flying, which in recent years has risen alarmingly.

Managing director of Agricultural Aviation Co., Ltd., is Mr. D. F. Speck, who has an extensive background of agricultural flying in the U.S.A., South America and this country. The company's chief designer is Mr. Arthur Ord-Hume. Among future projects is one for an agricultural version of the Luton Major.

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Straight and Level

IT was about 15 months ago, on June 7, 1957, that *Flight* first came to the conclusion that B.O.A.C. had decided to eliminate the turboprop from their future plans and to concentrate on an all-jet fleet.

Was this conclusion right or wrong? The Corporation subsequently said that they would have a place for the turboprop "as far ahead as could be seen."

But writing in the *Financial Times* recently Sir Gerard d'Erlanger, B.O.A.C.'s chairman, said that his Corporation's future plans are "based on an expanding market for air travel and the operation of an all-jet fleet . . ."

● Have you ever wondered where the American aircraft industry finds all its research staff, design staff, production staff, etc., etc., needed to carry out its really large-scale projects? Well I hadn't—not until recently, when I saw a copy of the programme of a certain joint aeronautical meeting on the other side of the Atlantic. One paper was presented by a man whose position was "Chief Human Engineer, Grumman Aircraft Engineering Corp." Very well, we can account for the human engineers—*but what about the others?*

This may be the explanation of an old conversation I now conveniently recall. It concerned the terrible cockpit visibility of a certain American aircraft. "Who designed it?" a friend of mine asked. "Oh, it was just one of those Things," a company official replied.

● I am rather losing patience with people who invent Soviet designations in order to appear well informed. Such folk have had quite a run for their money with aeroplanes, and now they are trying their luck with missiles. A surprising number of Russian missile designations are being bandied about: a recent issue of a renowned German magazine contains descriptions of 27 Soviet weapons, all referred to by very impressive-sounding designations, upon which I shall personally reserve judgment.

Here, surely, is an obvious need for code-names. I cannot help sympathizing with *Flight's* technical editor who, in preparing this journal's last annual review of the world's missiles, had to choose between giving the known Russian missiles his own code-names, or using a whole string of designations like "POL-2" and "Komet 2 CH-18," which may either be quite correct or pure invention.

● While on this subject I feel impelled to remark that several writers have not only invented designations for Russian aeroplanes and missiles; they have also invented the aeroplanes and missiles themselves. Do you remember those wonderful Russian bombers with six turboprops? And that host of double-bubble airliners and turboprop derivatives of the Tu-4 (B-29)? And there were whole families of twin-jet, all-weather fighters which I am sure never really bore the markings of the Red Star.

● The British independent airlines have been building up cheap-fare air travel in quite a remarkable way. So much so that B.E.A. last year said that package-tours to Continental sunshine resorts were diverting their traffic. And B.O.A.C. are saying the same thing about Colonial-coach Safari services to Africa.

What seems rather odd to me is that the Corporations should lay their complaints before the public—a public which is interested only in cheap air travel.

Both Corporations have of course complained through the appropriate official channels. But what do they want done? Do they want the cheap-fare traffic for themselves? Or do they want it stopped altogether? Surely not the latter?

● Pratt and Whitney's J58 is almost certainly the most powerful turbojet to have run in the Western world, and one can assume that it is probably also the noisiest. The company are fortunate in that their "Florida research and development center," where the J58 programme is based, is in a sufficiently isolated spot for static testing to be done in the open air, unsilenced. They state that "continued isolation is insured (*sic*) by a vast wildlife sanctuary in which the Center is located." Anybody taken a census of the local wildlife lately?

● Convair have a proposal for a ballistic cargo missile, known as Lobber, for the rapid re-supply of forward areas in a battlefield, or for laying cables or hose, or putting down cameras or radio equipment. What interests me is the occasion chosen to reveal this delightful concept: it was the Ninth National Noise Abatement Symposium, in Chicago.

● Rear-Admiral George P. Thomson, R.N. Retd., is known and respected by almost every British journalist. His opinions are usually the result of careful deliberation, and he is not a man to make unqualified assertions without first taking care to ensure that he cannot readily be shot down. He recently said: "To spend money on land-based rocket sites is just nonsense."

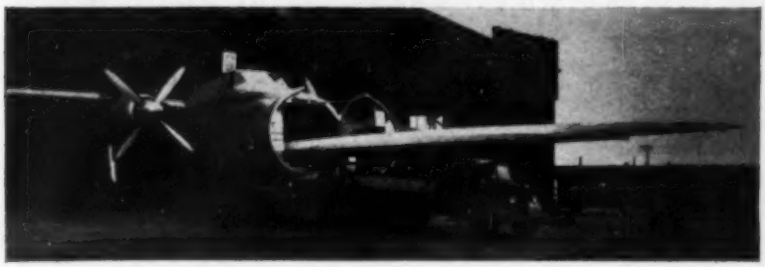
Even allowing for the fact that for centuries admirals have loved to take pot-shots at arms which do not float, and that sniping at Thor is a particularly popular pastime among old sea-dogs just now, this is a startling statement. I must give it my earnest consideration; after all, I'm paying for these sites, and so are you.

● When, some months ago, Playcraft Toys, Ltd., sought the assistance of *Flight* in ensuring the accuracy of some missile models they were anxious to produce, it seemed that they were embarking on an undesirable venture. Quite apart from the ethics of giving representations of engines of nuclear destruction to cherubic children, it appeared a foregone conclusion that no missile could ever be as attractive in model form as a swept-wing fighter or an armoured vehicle. In the event, Playcraft have shown that the new species of weapon can look wonderful in miniature form. They have evolved a whole Bloodhound weapon system, complete with launcher and vehicles, and are well on the way to doing the same with Thunderbird. Now youngsters can have fun trying to fit them into their existing defence environments, without the problems of NATO standardization or give-aways from the U.S.A.

● Seen on the apron at Hatfield during the recent Comet 4 production hustle: three wheel-chocks and a notice saying: *Keep Off—Aircraft Cleared For Flight.*

ROGER BACON

Almost everyone knows that Bristol designed the Freighter Mk 32 so that it could accommodate 60ft racing shells; but only this year has the aircraft fulfilled itself in this rôle. Here, in a picture taken during the summer, a Silver City aircraft takes aboard the boat belonging to the University of Washington Rowing Club, for consignment to Helsinki. If you think it was biting off more than it could chew, you should know that it was flown in company with a similar Russian boat



Representatives of B.O.A.C.'s two transatlantic turbine airliners at New York International Airport—Comet 4 G-APDE and Britannia 312 G-AOVD

THE STORY OF A B.O.A.C. TRANSATLANTIC JET TRAINING FLIGHT

"FLIGHT" PICTURES AND STORY BY J. M. RAMSDEN

COMET AT WORK: a Trip to New York

MOST captains and cabin staff in B.O.A.C. are well versed in the art of speaking over the passenger-address system, and the commander of our Comet 4 was clearly one of them. We had been in the aeroplane for as long as it takes to eat a barley sugar, listening to the ringing of bells up front as the captain completed the last items on the take-off check-list. "Good afternoon, ladies and gentlemen. I am sorry about this minor delay, but we are having a little trouble, most unusual in this aircraft, with one of our warning light circuits . . . I expect our engineer will put it right as soon as he finds the right circuit-breaker." Informative and relaxed, this announcement qualified as good passenger-relations, as important to the well-being of the customers as all the sophistication and refinement of *Monarch* cabin service. Just as a passenger can often judge a captain by the way he taxies his aircraft, so he can judge one by his passenger-address technique.

The fault was found in a few moments, and one minute after starting engines—a procedure accompanied by a distant rumble and a barely perceptible tremor of the structure—we moved smoothly and quickly over London Airport's taxi-ways towards runway 28L. There was no exertion of assymetric engine effort and only the most delicate use of the brakes. The commander's voice again as we lined up immediately for take-off: "This is the captain speaking. Our take-off will be in accordance with the noise-abatement procedure, so as to cause the least disturbance to communities below, and our angle of climb will be rather steep. For those not used to jets, our acceleration is also a little stronger than on piston-engined aeroplanes . . ."

The Avons surged to full 8,000 r.p.m. power, temporarily prohibiting normal conversation, the wheel-brakes were released gradually—not crudely as on many jet take-offs—and after 20 seconds we lifted clear. Immediately the tail went well down, and one's impression during the next half-minute was of an extremely rapid, but by no means alarming, recession of the houses and fields below. The new noise-abatement technique is to make the initial climb at V_2+15 kt (about 145 kt at maximum weight). After 30 seconds we were at 1,500ft, the flaps moved up from their 20 deg take-off position to neutral, power was reduced to 7,350 r.p.m., and a normal Comet climb-attitude was adopted. The normal climb speed of 260 kt I.A.S. was reached at a height of about 6,000ft.

This was a crew-training flight, and on board were 10 Comet flying staff—captains, first officers, navigating officers and flight engineers. All had had transatlantic Comet 2E experience, and were being route-checked on the Comet 4 by Capt. E. E. Rodley—a senior Comet Flight skipper who had been training captain of the early Comet 1 fleet. Also on board were eight cabin staff.

The weather situation all the way to New York, and at all the alternates *en route*, was so good as to have evoked a "this isn't possible" from the pilots grouped round the aerodrome forecast charts at the pre-departure met. briefing. Cloud-tops all the way were to be 23,000ft at the most, with very little cirrus to roughen our ride; and every alternate was likely to be wide open, with 12 miles visibility at Keflavik, our first stop. But winds were to be strong—up to 120 kt on the nose at 30,000ft. This was about 30 kt higher than average for the time of year. We could in the circumstances have flight-planned for Gander, even with a full commercial load, but a stop at Keflavik was scheduled for training reasons.

Before discussing the commercial transatlantic capabilities expected of the Comet 4—which look good despite all the cynical

The scene in the forward de luxe class cabin of the Comet 4 as the cabin staff prepare to serve the Monarch luncheon. There are 16 chairs in this cabin, and 32 first-class seats in the rear cabin. Other possible one-class arrangements include 40 de luxe, 56 first-class, 71 tourist, and 81 economy. Cabin quietness in the forward cabin is of an exceptional order, noise level rising slightly in the aft cabin. Most seats in all Comet 4 layouts are forward of the jet-pipes

The Comet 4 at New York International, looking towards the control tower and the B.O.A.C. offices and departures area. Leaning over the Hobart ground power truck (112 V, 250 amp and 28.5 V, 600 amp) are the Rolls-Royce and de Havilland technical representatives at New York

"it-was-never-designed-for-the-Atlantic" comments—we might first consider the aircraft from the passenger's viewpoint.

You can choose between de luxe-class or first-class. There are 16 generously spaced (56in) de luxe chairs in the forward, quietest part of the cabin; and 32 first-class chairs in the aft cabin. The choice depends upon one's ability to pay the £18 de luxe surcharge on top of the £155 first-class one-way fare. For this amount in the Comet one gets exceptional quiet, more leg-room (and incidentally more dumping-room for personal effects), full recline, and a sleeperette-extension. Most airlines find that, where a choice is offered, de luxe accommodation usually gets booked first. In general, class-distinction between de luxe and first is becoming as hard to justify as between tourist and economy. Whether this proves to be so in the Comet remains uncertain; but what *is* certain—whatever you pay—is that you recline in what must be the most tastefully styled airliner cabin to date.

The standard interior of the Comet is a work of art, a masterpiece of design so subtle that print can but inadequately convey the pleasure which it gives. Worth quoting is the first reaction of an American lady passenger: "My," she said, "isn't this the dreamiest?" One particular subtlety is the variation in colour of the linen headrests and cushions, and of the chair-upholstery. It would be a pity if—as in our Comet—these colours were to be made uniform in the philistine interests of engineering standardization.

The chairs, by Microcell, are most comfortable, their only snag —to use the word in both its senses—being the cup-holder when in its folded position. Under each chair in our aircraft (G-APDE, Chester-built) were temporary oxygen-bottles and masks pending the retrospective installation of the Walter Kidde passenger oxygen system, which automatically presents each passenger with a mask in the unlikely event of cabin height exceeding 14,000ft. Having previously seen this system demonstrated, one seriously wondered whether the very sudden presentation of masks from the hatracks might startle many unsuspecting passengers. The stewardess always demonstrates the lifejacket drill in jet airliners (see below), and an oxygen demonstration might well become standard emergency drill also.

B.O.A.C.'s Monarch cabin service has become a byword on the North Atlantic route, and, of course, its refinements could not have a more appropriate setting than the aesthetically pleasing and physically tranquil cabin of the Comet. The traditional silver trolley is retained, a fetish which must never be dispensed with, though in the Comet it may be that a reduction in wheel-track would permit the freer flow of cabin staff up and down the aisle.

In a little more than half an hour we had climbed to 35,000ft, the start of our flight-planned cruise-climb, a point predetermined by our weight and signified by a barely perceptible change in engine note as we throttled back to the cruising r.p.m. appropriate to the outside air temperature. Unlike the old Comet 1, the new Comet has plentiful power, and tends to be more Mach-limited than power-limited. The cruising Mach number at present selected by B.O.A.C. for Comet 4 cruise-climbs is 0.73, this being deemed to give the best combination of speed and range. Cruise-climbs are made at constant 0.73 Mach and at 1.15 times minimum drag speed, r.p.m. being adjusted as fuel weight is burnt off (the engineer passes a weight statement every half hour) and as height is gained.

A cruise-control chart tabulates for quick reference how I.A.S. and height vary with weight for a given Mach number, and how r.p.m. vary with outside temperatures. A glance at this table shows how plentiful is the Comet 4's power: for the typical temperature of −40 deg C recorded at this point on our flight, optimum r.p.m. were 6,970—considerably below the maximum recommended Avon 524 cruise rating of 7,360 r.p.m. Only in the "hottest" conditions—for example, in outside temperatures of minus 12 deg —is the full 7,360 r.p.m. specified. This means that the Comet's engines spend a good deal of their lives relatively relaxed, which helps to account for the overhaul life of 1,000 hr already achieved, and for the prospect of 1,500 hr in a year's time.

Though we had flight-planned to cruise-climb from 35,000ft up to 39,000ft, where we would start our descent to Keflavik, this was not to be. Comet commanders always ask for a cruise-climb clearance, but more often than not air traffic control cannot grant it. On the day of our flight the U.S.A.F., as apparently is their wont, had "reserved" all the airspace on our route above 35,000ft, and we were held down to this height for the whole of the two-hour cruise to Keflavik. (On the next sector, Keflavik - New York, we were cruising at 40,000ft when at the request of Montreal we had to descend to 33,000ft—again because the air which we wanted to use for best economy had been reserved for several hours for military traffic.)

Needless to say, such obligatory deviations from the optimum cruise-climb flight-plan are not going to be greatly appreciated by commercial jet crews in the future, even though they may be grudgingly tolerated now. There is no doubt that the economy of commercial jet operations will largely depend upon the ability of air traffic control authorities to give cruise-climb clearances to jet commanders. But of course the present A.T.C. system of separating aircraft vertically is rendered useless by aircraft which

Left, Stewardess Pamela Ellwood demonstrates the routine lifejacket drill before departure from London. Right, a glimpse of Monarch service being dispensed from the traditional silver serving trolley

Flight-deck scene at 39,000ft over Greenland, having flown northwards from track to avoid headwinds. The pilots were being route-checked on the Comet 4 by Capt. E. Rodley

COMET AT WORK . . .

are changing height every minute. Even in these very early days of transatlantic jet services cruise-climb clearances are few and far between; the situation in a year or two's time, when scores of commercial jets are all clamouring to cruise-climb in both directions—conflicting with each other as well as with military traffic—does not look promising.

If separation standards are to be safely maintained, the commercial jets will—according to present rules—have to be prepared to deviate considerably from their optimum flight profiles. In the meantime the solution appears to be in the magic word Dectra. This system, which permits accurate track-keeping and hence lateral separations, is inevitably mentioned whenever the jet separation problems are discussed. B.O.A.C. had it fitted in a Comet 2E, and part of the Comet 4 fleet will almost certainly be Dectra-equipped also.

Despite the difficulties of obtaining cruise-climb clearances, B.O.A.C. nevertheless base their Comet 4 flight-planning procedures on the assumption that optimum flight profiles will be followed. Thanks to B.O.A.C.'s long experience of jet operations, this flight-planning system appears to be remarkably simple. Compared with Comet 1 and R.A.F. Comet 2 procedures (and even those recently employed by B.O.A.C. on the 2E), the flight-planning technique evolved for the Comet 4 could well be described as a new concept in jet airliner operations (see footnote).

Our cruise to Keflavik had to be a constant-height (35,000ft) affair, and outside the windows was evidence of the small amount of energy which we were wasting as a result: in the extended position on top of the inboard nacelles were the automatic bleed-valve flaps which, with a noticeable rushing noise, were spilling air from the inboard compressors. This same sound was more pronounced during the descent, when for best economy the inboards were throttled back to idling r.p.m. (pressurization being maintained by the outboards). The start of the descent was determined on this leg in an unusual way: our Ekco cloud radar began to paint the Icelandic coast 200 miles away, the point at which the descent was due to begin. Generally, in the absence of DME on the Atlantic, the critical point at which Comet descents are begun is fixed by normal navigational means—Loran, Consol, or just plain beacons when overland. The descent was made according to the "best economy" technique, in which speed is reduced to 220 kt at the top of the descent and thus maintained down to 5,000ft. No flaps and no air brakes were used, though the latter would have been applied had we elected to adopt the high-speed descent technique.

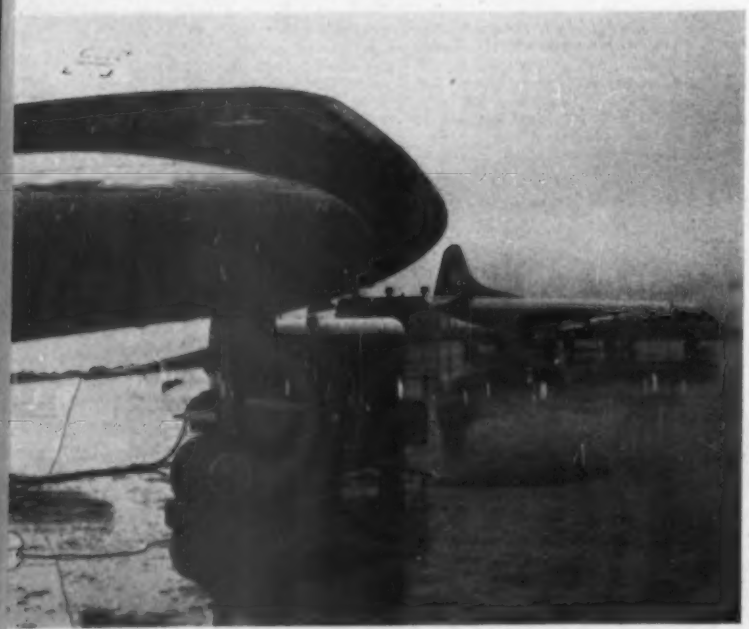
We had an unexpected neighbour on the apron at Keflavik—Lockheed's demonstration Electra N7144C, bound for the I.A.T.A. annual meeting at New Delhi—and for many other ports of call in Europe and the Middle East before the end of November. In between demonstration flights for U.S.A.F. and U.S. Navy F-89 Scorpion and P2V Neptune personnel, Captain Rodley and Lockheed test pilot Butorac exchanged visits to each other's flight deck. In the Comet the Lockheed pilot commented that visibility was comparable with that from the Constellation, perhaps rather better. Did the Comet have a speed-retention lock? What was the flight instrument system like?

In the Electra Capt. Rodley, sitting in the left-hand seat, remarked on the spaciousness of the layout. We were shown the engineer's station, which is incorporated in the big flat-topped central pedestal, and the "panic switches," the appropriate one of which is pulled in an engine emergency to initiate automatically the correct sequence of actions (i.e., electrics off, engine oil off, cooling air to nacelle off, cooling air to generator off, fuel off, bleed valves off, fire extinguisher armed, feather). Throughout the Electra's half-hour turnround, and while we were on board, the starboard Allison 501s continued, slightly disconcertingly, to run at their 16,000 r.p.m. constant speed. "To get power," we were told, "we just pump in more fuel and change the blade angle." All the Lockheed representatives were most enthusiastic, as well they might be, about their aeroplane. The flight deck and the visibility are excellent, and the layout clean and tidy. "It takes an idiot to fly this thing," said Butorac, "that's why I'm on this trip. . . . The most complicated thing in the cockpit is the seat adjustment." We were given three copies of the "Electrapedia," a king-size super-sales brochure on every aspect of the aeroplane, including suggested ready-made stories for reporters. The cabin, incidentally, was bright and colourful, but—by Comet standards—rather lacking in style.

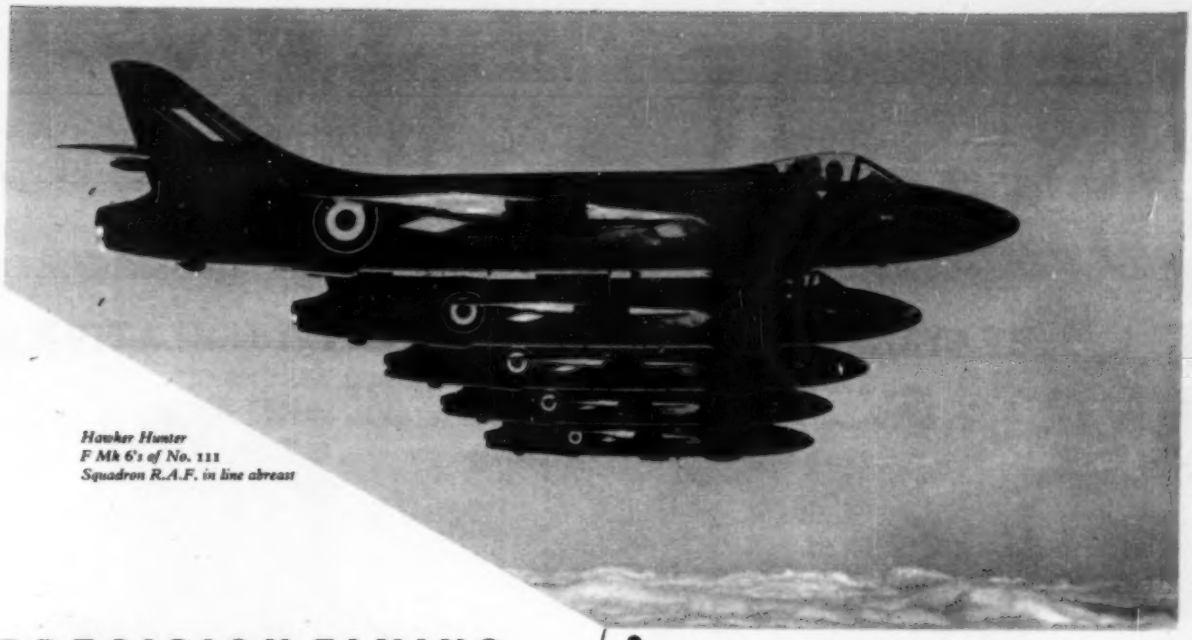
Our flight from Keflavik to New York (having reached 1,000ft before the end of the Keflavik runway) took about six hours. We flew more than the 2,300 n.m. great-circle distance, following a north-about track across the glacier-coursed mountains and ice-deserts of Greenland in order to avoid a "low" and strong headwinds to the north, and turning south over Fort Chimo at 41,000ft. This kind of manœuvre, which Atlantic skippers perform every day (saving hours by deliberately flying hundreds of miles off track), was a reminder that jets ideally want not only variable heights but variable tracks also—in other words the A.T.C. bun and the halfpenny as well. Someone has yet to suggest the kind of equipment and A.T.C. system which would make this sort of operation practicable.

We were held at 20,000ft over New York for nearly half an hour, orbiting over Long Island, with a Pan American Boeing 707 somewhere in the circuit on a night-training flight. Below, as far as one could see in every direction, were the lights of New York State, a scene of curious purity and power. A fast descent with air brakes out, followed by a long, low approach, brought us boring across Jamaica Bay at high thrust and with lots of flap to a floating, leaf-light touchdown on New York International. The ice which had formed on our nacelle tanks indicated that they were one-third

(*Concluded on page 669*)



The first meeting of the Comet 4 and the Electra at Keflavik. The Lockheed aircraft, a sales demonstrator, was at the beginning of a lengthy tour of Europe, the Middle East and India



Hawker Hunter F Mk 6's of No. 111 Squadron R.A.F. in line abreast

PRECISION FLYING

The delicacy of handling required for formation flying is born of a combination of human skill and expert hydraulic engineering. The characteristics of Fairey hydraulic power control units contributed greatly to the magnificent displays of flying given at this year's S.B.A.C. show at Farnborough by Hawker Hunters, Vickers-Supermarine Scimitars and Armstrong Whitworth Sea Hawks.

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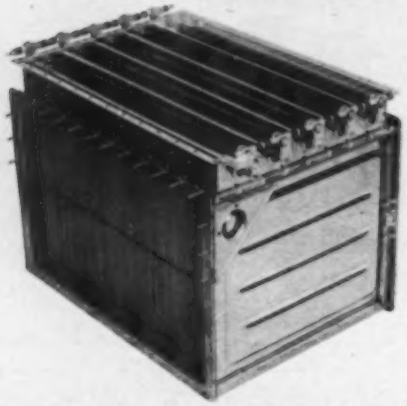
If your problem

HEAT EXCHANGE



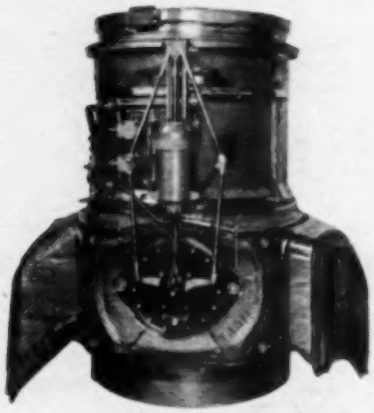
WE DESIGN and manufacture heat exchangers for many purposes, in both light alloy and stainless steel.

The example shown is a gas-to-air heat exchanger for the anti-icing system of the Vickers Vanguard. This system, which is exclusive to us, actually *prevents* ice from forming, and enables aircraft using it to fly when others are grounded. Although made of stainless steel, it is no heavier than a comparable one in light alloy, because of our skill in working with very light gauge metal.

Other typical exchangers of our manufacture are used for cabin heating in piston-engined aircraft, utilising the heat from the exhaust; for oil cooling, and for fuel heating and oil cooling at one and the same time in turbo-prop engines.

We have supplied heat exchangers for the following aircraft, amongst many others: the 'Britannia,' the 'Vanguard,' the 'Viscount,' the 'Herald,' the 'Argosy' and the 'Friendship.'

HEAT INSULATION



OUR THERMAL insulation blankets can be designed to fit *any* component, as this example shown fitted to the Rolls-Royce thrust reverser of the de Havilland Comet proves. They are also planned so as to be easily fitted and removed, to retain their shape throughout the life of the component and to give the maximum insulation compatible with their low weight of .65 lb per square foot.

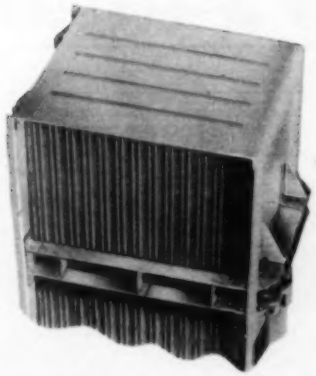
Construction is of silica refractory cased in .004in stainless steel, the steel being dimpled for greater rigidity. They are completely sealed against the ingress of fuel, and are fully approved by the A.R.B.

Aircraft for which we have recently supplied insulation blankets are the 'Comet,' the 'Caravelle,' the 'Drachen,' the 'Friendship,' the 'P.1' and the 'Javelin.'

. . . we can help

is here . . .

BRAZING & WELDING



ALUMINIUM FLUX BATH BRAZING makes the impossible possible.

WE CAN, and do, join metals by every known commercial method, but of them all our flux bath for aluminium offers the most *extra* scope to designers.

It really does make the impossible possible. Design inaccessible joints—as many as you wish. Use aluminium thin as foil. Think in terms of very close tolerances. All these things you can do. And you can combine them in units so small, so light and so efficient that it would be *impossible* to make them by any other method.

Designing for dip brazing need present no problems. We shall be happy to design for you, or if you prefer it, to discuss possibilities with you and then work to your own design.

We are sub-contractors to both the Aeronautical and Electronic Industries.

STAINLESS STEEL

THIS FLANGE was made from ¼in stainless steel strip. Impossible? Yet we did it! How long did we take to make it? The astonishing answer is *a few days!*

We have evolved new techniques for handling stainless steel. Many items previously only obtainable by long and costly processes, such as forging or drawing, we can now make quickly and economically *without* involving you in *any* tooling costs.

If you want something made from stainless steel (any gauge from .002in to ¼in) that you think is out of court because of time or price factors, or just plain impossible anyway, please ask us about it. Asking will cost you nothing, and it may well be that we can help you.

Both Hunting Aircraft and Scottish Aviation are amongst those currently using our services.

you

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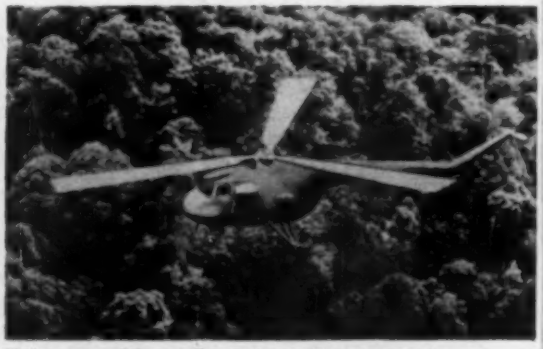
VULCAN WORKS, EDGWARE ROAD, LONDON, N.W.2 TELEPHONE: GLADSTONE 2201

Your flying career begins. Once you have received your 'wings' and completed your operational conversion training, you are ready to join a squadron. This is one of the big moments in a career crowded with adventure, travel, opportunity, and achievement.

Will you fly V-bombers? You must be good to be selected for V-bomber duties. The responsibilities call for sound teamwork. The crew of a V-bomber consists of two pilots, two navigators, and an air electronics officer.

Of course there's a future

Will you fly Comets? This Comet 2 has a stage length of more than 2,200 miles against a 50-m.p.h. headwind. The cruising speed is 480 m.p.h. and the cruising altitude is 35-40,000 ft. The Comets provide the R.A.F. with that essential quality of mobility so vital in air strategy today.

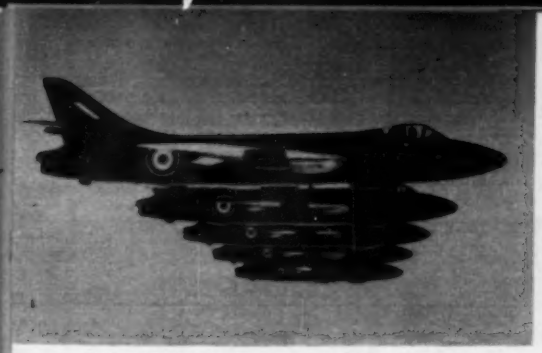


Flying on special operations. Men of jungle patrols in Malaya depend on the helicopters of the Far East Air Force for ammunition, water, food, and often their lives.

if you're good enough to fly

Can you shoulder responsibility? The greater your experience as an aircrew officer, the greater your responsibilities: to the men under you: in administrative liaison or training. Air traffic control typifies some of the duties that may come your way.

You continue to fly. In spite of heavy responsibilities, a high-ranking officer continues flying throughout his career.

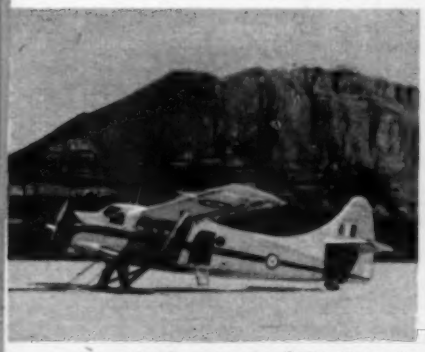


Flying display. Only experienced crews, of course, take part in special air displays. Here in a display of formation flying, pilots demonstrate their aerobatic skill by putting Hawker Hunters through their paces.

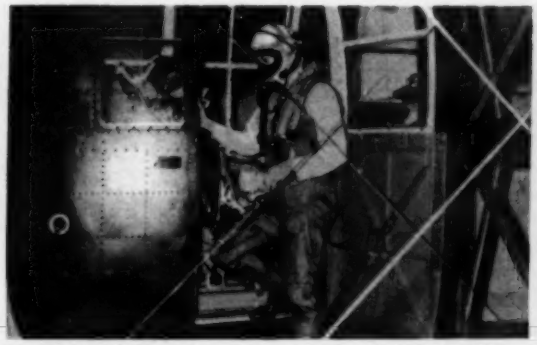
Will you fly fighters? Never have the fighter pilot's responsibilities been so great. Defence is a high priority and calls for special flying skill in developing air-to-air guided missile tactics.

Trans-global flying. Transport Command pilots must have the temperament and skill to take the world in their stride.

in flying in the missile age...



How adventurous are you? This Otter aircraft, taking part in the Trans-Antarctic Expedition, was flown 1,460 miles non-stop over the South Pole by the R.A.F.



Research into flying. At the R.A.F. Institute of Aviation Medicine, a medical officer, a qualified pilot, wearing the latest flying clothing, prepares to enter the man-carrying centrifuge used for studying the reactions of men subjected to 'g' forces.

Off-duty flying. The Tiger Moth, dwarfed by a Beverley C.1, the R.A.F.'s largest aircraft, belongs to the squadron's flying club.

with the Royal Air Force

Time for recreation. Teamwork, in work and play, is encouraged. Rowing is just one of the many sports and recreations organised by the R.A.F.

The Royal Air Force
Flying ... and a career

How to fly with the R.A.F. You must be between 17½ and 26 and absolutely fit. You must have the G.C.E., the Scottish Leaving Certificate, or their equivalent. Write, stating age and education, to the Air Ministry, Dept. FR 24, Adastral House, London, WC1.

Well done, de Havilland!

We are proud to have been associated with you in this magnificent achievement.

The HENDERSON SAFETY TANK COMPANY LIMITED, Aeronautical and Sheet Metal Engineers, have worked in association with the de Havilland Aircraft Company for the past 18 years, and for the Comet IV have manufactured the Air Intakes, Skin over Engines, and Luggage Bay Floor Panels, etc.

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In this and the following pages "Flight" presents a story-in-pictures of Comet 4 production from genesis to service, and of some of the men whose daily concern is the manufacture, testing and operation of Britain's pure-jet airliner

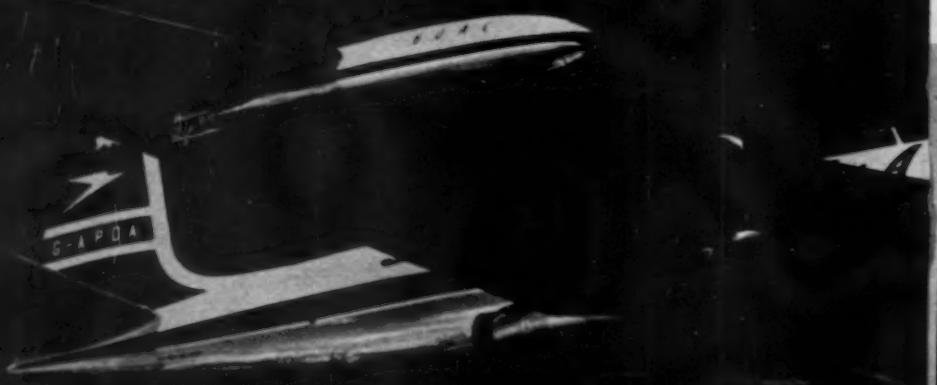
COMET AT WORK

DESIGNING

GRACEFUL product of ten years of Comet design and development, G-APDA, the first production Comet 4, is pictured here over Hatfield, Herts. On the right is Hatfield House, the home of Lord Salisbury. To the left is the old part of Hatfield and the main railway line to Scotland, and de Havilland's works and aerodrome are just out of sight beyond the Comet's nose.

The smaller picture shows the interior of one of the de Havilland drawing offices at Hatfield. In the foreground are (right to left) A. G. T. Peters, now responsible for Comet production design under C. T. Wilkins, chief designer of de Havilland Aircraft; H. M. Will, of the Comet design team and assistant to Mr. Peters; and J. C. Spicer, a drawing office section-leader.

(Continued on page 662, after double-page views of Comet 4)



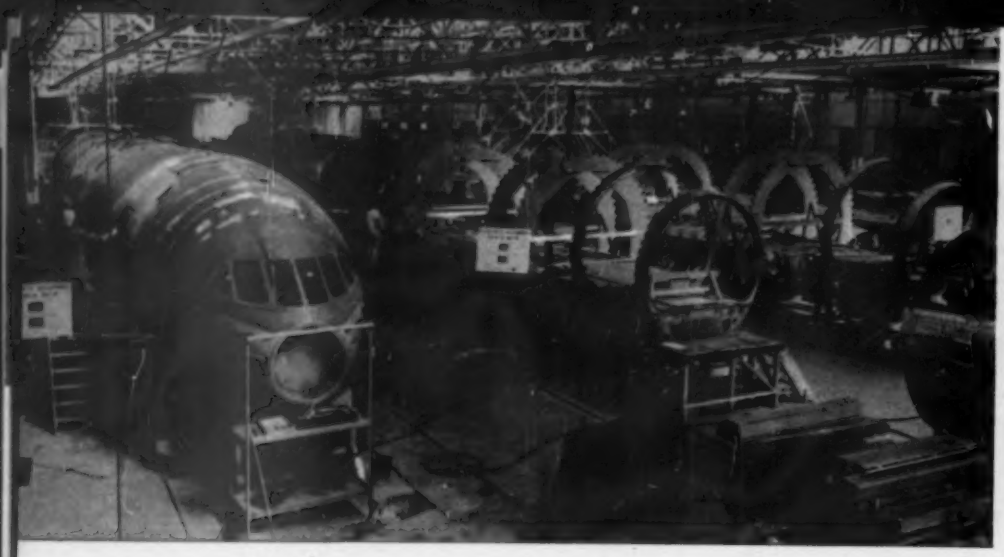
de Havilland COMET 4

(Four Rolls-Royce Avon RA.29)
Span 115ft
Length 111ft 6in

A sudden, wonderful upsurge of public excitement that took even B.O.A.C. and de Havilland by surprise (last week queues formed for seat reservations at the airline's booking offices) greeted the introduction of the Comet 4 on transatlantic services earlier this month. For de Havilland October 4 marked the achievement of a goal which five years ago required a considerable act of faith to see. For B.O.A.C., the first scheduled North Atlantic jet service was a milestone in air transport history and the culmination of a vigorous and carefully planned period of training. G-APDA, the aircraft pictured here, was the first Comet 4 to be completed. It bore the brunt of the proving and training flights that made possible the early start of services

"Flight" drawing
by D. I. PUNNETT

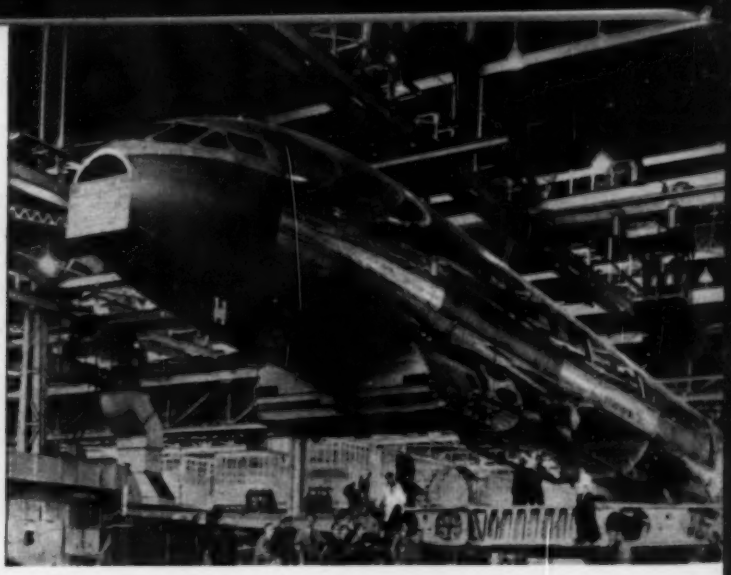
"Flight" photograph
by L. W. McLAREN

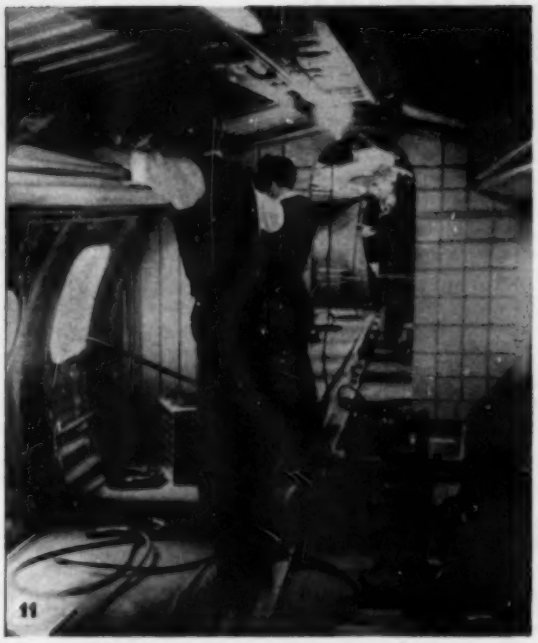


COMET AT WORK...

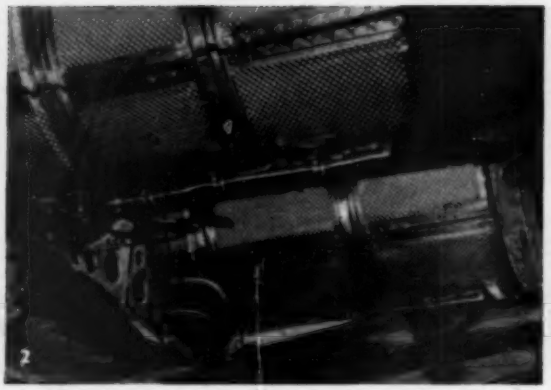
BUILDING

Each of the photographs on these pages shows an aspect of Comet production —detail fitting, sub-assembly or work on the assembled airframe—at Hatfield or at the de Havilland northern factory at Chester. (1) Fuselages in the Hatfield assembly shop are built upwards from the keel; skins and stringers are added in two sections. (7) H. Wood and J. Cartmell work on the fuselage side panels. (2) Detail trimming of interior fittings. Three pictures show operations on the fuselage skins: (10) window frames are spin-dimpled by G. Hough and apprentice Brian Heeson; Don Green and R. Matthais (9) prepare the skins for bonding and (3) F. J. Robinson (left) and Robert



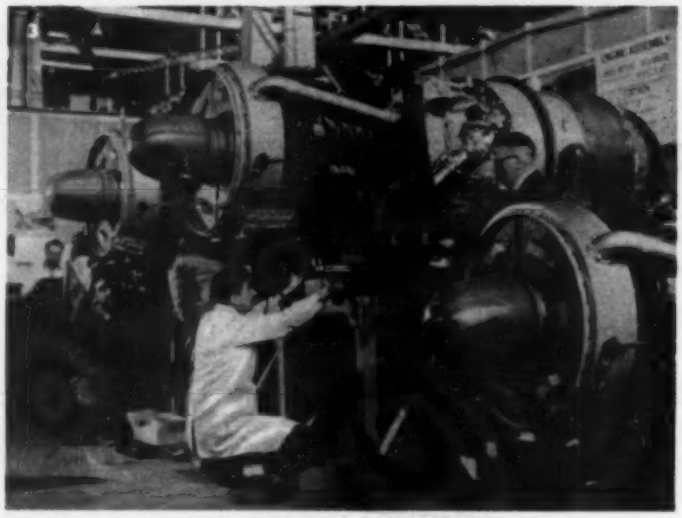


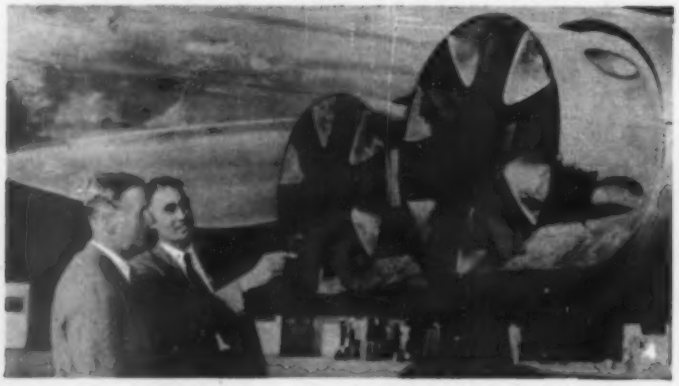
Watling carry out the Redux process. A high polish on the wing skins (4) is being achieved by W. Allan with a Morrisflex. (5) This view of the Chester factory shows the fuselage, slung in cradles, being lowered for attachment to the wing. (6) Wing-root fittings are jig-drilled to the centre tank attachments. (8) Manufacture of leading edges at Chester; assistant foreman J. D. Earnshaw assists David Morris. (13) Vic Suttervy (works inspection) examines the flying control surfaces. (14) Albert Manning is sculpture-milling a rear spar web on a Wadkin machine. (11) Installation of baggage racks. (15) Early delivery to B.O.A.C. of four Comet 4s required some intensive work at Chester. Photographs (12) and (16) show the assembly line at Hatfield. In (12) the fuselage has been masked prior to painting but has not yet been sprayed. The protective coating is retained until the fuselage is finally polished before delivery. In (16) the assembly line starts at the far end; B.O.A.C.'s first three aircraft were built here.



POWERING

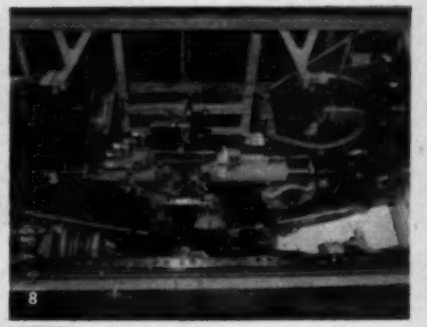
Powered by Rolls-Royce: there can be fewer four-word phrases that instil greater confidence in the airline passenger, the operator or the maintenance engineer. Long years of military development with progressive increases in power, intensive proving for civil use on test beds and in the air, and 4,000 hr of Comet 2E proving flying have resulted in an engine cleared at the start of scheduled services for 1,000 hr between overhaul. This will mean much to the Corporation as Comet utilization is extended to the target figure of about 4,000 hr a year. The floodlight scene (1) shows Chester's first Comet 4—now delivered—during the course of engine runs to prove the installation. In picture No. 3, three of the four 10,500 lb-thrust Rolls-Royce Avon 524s (RA.29s) are being prepared at the Chester factory before being fitted; previously winched up, they are now finally raised into position by means of a special trolley. In (2) engines and jet-pipes are in place and the protective stainless-steel shrouds manufactured by British Refrasil have been laced into position. The drain pipes are Palmer Corruflex and Palmer flexible metallic.

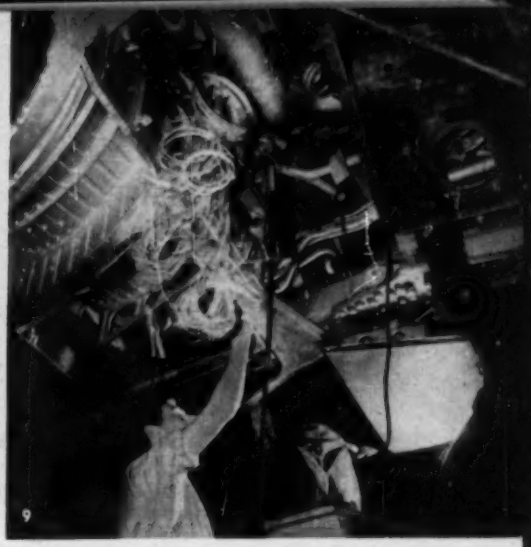


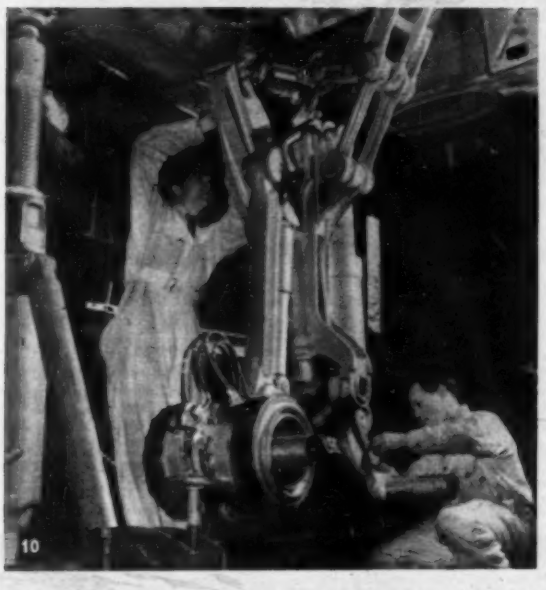


QUIETENING

Interior quietness of the Comet's cabin results from the soundproofing of the fuselage and the silencing of the four Avons. The "daisy" silencers (4) are sufficiently effective in subduing external noise to permit the Comet 4 to operate under the special regulations imposed by London and New York with no limit on maximum weight. Here John Cunningham, de Havilland's chief test pilot, discusses the silencer with Mr. Greatrex, of Rolls-Royce, the man who has given his name to this type of noise suppressor. In (5) and (6) are illustrated the fitting of packaged Fibreglass soundproofing between the fuselage frames before the wall lining and trim are added.





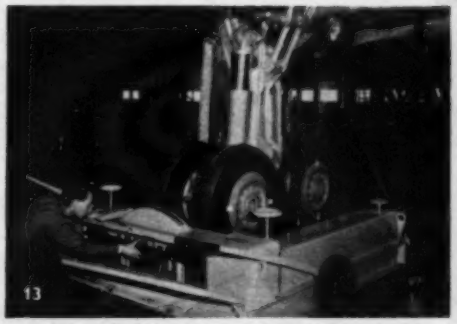


EQUIPPING

After the engines are installed fuel and electrical connections must be made. Here (7) E. R. Taylor works on the starboard outer engine. Installation of the Lockheed Servodyne aileron power controls is shown in (8). Similar units power elevators and rudder. The last-named is fitted with a Smith's yaw damper. Some of the multitude of electrical cables that pass from wing to fuselage are seen in (9), which also shows the wing fitting for the front-spar attachment. Many of the circuits terminate at the cockpit panel, seen in (11) being inspected by G. Pryde; the electrical power system is designed and supplied by B.T.H. (12) Oxygen bottles for the Kidde emergency passenger system being fitted into the luggage bay by J. G. Davis. D.H. design and manufacture the main bogie undercarriage, seen in (10) being installed by Johnny Briggs, left, and Jack Garrat. The wheels and Maxaret brakes are supplied by Dunlop, who also supply the tyres.

FURNISHING, FINISHING, WEIGHING

Detail fitting of the interior of the Comet 4 fuselage at D.H. Chester factory (14) is a task undertaken here by W. L. Fitzsimmons. Furnishing is not fully completed until the aircraft is delivered to B.O.A.C., who install the Microcell seats (15). (16) Among the final finishing operations is that of painting the registration letters on the almost complete aircraft. The painter here, working on the first Comet 4 to be completed at Chester, is W. Pasinski. (13) When the aircraft is finally completed it is weighed on this 60,000 lb capacity Parsons machine.



COMET AT WORK... ***TESTING***

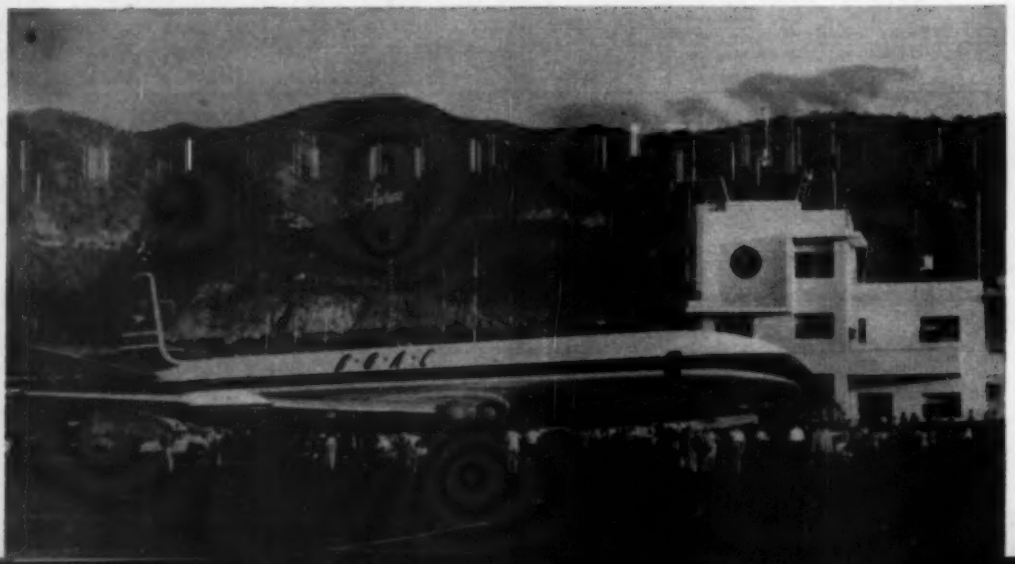
Production test flying is the responsibility of Pat Fillingham, de Havilland chief production test pilot. In picture (1) Mr. Fillingham and his flight-test observer, Stan Borrie, discuss a Comet 4 test flight with, left, D. L. Watts, Comet flight engineer and L. E. F. Young, deputy chief flight engineer. Each machine is subjected to about 15 hours' testing, spread over three or more flights. The simple flight-progress board in the background (adapted from Vampire days) is sub-divided to show the progress of air and ground tests. Comets G-APDA, DB, DC and DE have been passed. The sequence shown is cabin pressurisation check; high Mach number, high altitude run; cruise fuel consumption; high I.A.S. run; stall; mag check and engine handling out.

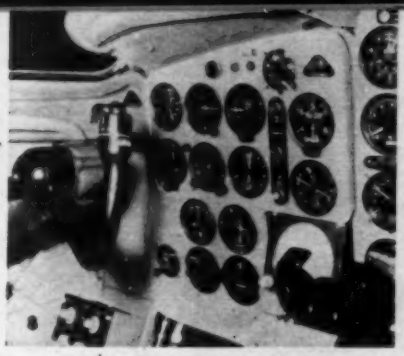
PLANNING

Planning B.O.A.C.'s Comet 4 operations requires continuous liaison with many departments in the airline. Gathered round a map of the world in the office of the flight operations officer (picture 2) are some of the men whose routine task is the daily and future operations of the Comet fleet. From left to right are D. A. Bishop, B.O.A.C. planning engineer; B. D. Monks and D. H. D. Lewis of the operations planning department; J. B. W. Angus Brooks, flight operations officer (Comets); C. O. White, Comet liaison officer, movements control; M. J. Ayres, flying staff administration and A. C. Mason, flight cabin services officer. This photograph was taken when the strike of B.O.A.C. maintenance engineers made Comet operational planning uncertain.

PROVING

Before the first passenger service began, proving (and record-breaking) flights to the Far East and North and South America were made by G-APDA. Photographs (3), (4), (5) and (7) were taken at Hong Kong, which the Comet visited for the opening of the new runway at Kai Tak. It returned on September 14 at an average speed, including stops, of 432 m.p.h. Eleven days later the aircraft was demonstrated on the other side of the world, at Caracas, Venezuela (6).



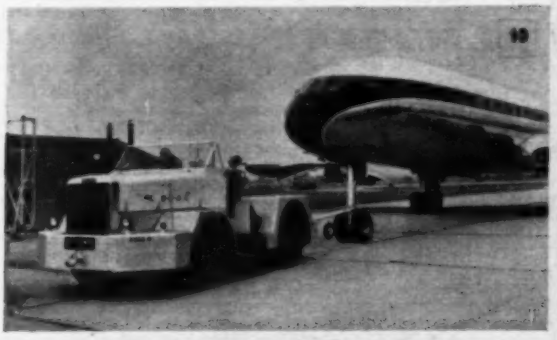


PILOTING

The cockpit (9): flight instruments are on duplicated panels for each pilot; engine instruments are carried on the centre panel; engine controls, S.E.P.2 autopilot, trims, flap and undercarriage levers, and fuel cocks are positioned on the console. Above the windscreen are the landing, taxi-light and windscreen demisting panel, warning light (including undercarriage lock) panel, twin radio panels and the hydraulic-servo power-supply selectors. This photograph was taken on the occasion of the first scheduled passenger service from London to New York. The pilots are Capt. R. E. Millichap, left, and Capt. K. J. Monk. (8) The Comet uses the Smiths Flight System and Ekco cloud-warning radar, the scope of which can just be seen behind the throttle/H.P. cock levers.

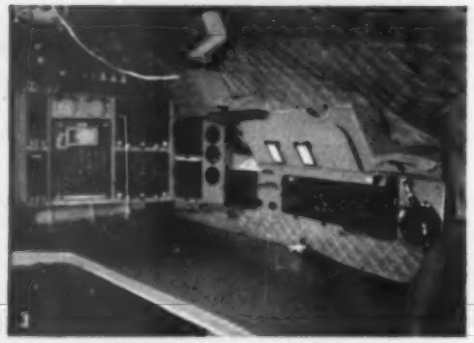
SERVICING

B.O.A.C. have introduced new Mercury Airtug 160L tractors (picture 10) for towing their Comet 4s at London Airport. A tractive effort of about 5,000 lb is required and the tow-bar pins are designed to shear at a predetermined load. The Comet 4 will turn about a point 13ft. outboard of either bogie. Servicing of engines and systems (12) is very largely carried out from below. Special equipment includes the low platforms used here for access to the starboard inner engine bay.



OPERATING

Primary prerequisite for passenger services is a normal-category Certificate of Airworthiness. On September 30, the Comet 4 C. of A. was formally handed over (11) to Sir Gerard d'Erlanger, chairman of B.O.A.C. (right) by Sir Geoffrey de Havilland at London Airport. Passenger services began on October 4, but training continued. G-APDE, seen in a "Flight" photograph (13) at New York International, had just arrived on a crew-training flight from London.



COMET AT WORK...

NAVIGATING

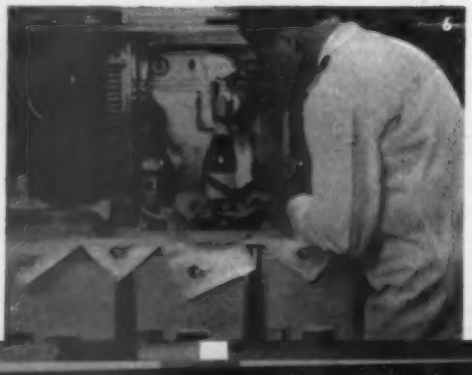
The navigating officer takes responsibility for the Loran and Consol. The panel (1) on the right side carries the Marconi radio system; the unusually spacious navigating table (3) is on the left side, flanked by radio aid presentation.

FLIGHT ENGINEERING

The engineer's panel (2), lit by Thorn lights, provides control of fuel, cabin air and electrical systems. Fuel flowmeters are by Negretti and Zambra and the cabin air system by Normalair. Cold-air units are manufactured by de Havilland Propellers.

CABIN STAFFING

B.O.A.C.'s Monarch flights have an enviable reputation for service. Working quarters for the cabin staff feature a G.E.C. galley and Hickman Airlardas. Stewardess Annette Hughes (4) checks the address system and Steward Tofield (6) prepares aperitifs.



PUBLICIZING

A major promotional effort—some of the special material is shown here (5)—was prepared by B.O.A.C. for the start of Comet 4 services. Difficulties were increased by the uncertainty of the first-flight date. (7) The first transatlantic passengers—correspondents—go aboard.

5

HALLEY'S Comet re-appears in 1985

DE HAVILLAND Comet appears NOW

With a new record—the first transatlantic Jet service—established by the Comet IV, Rotol and British Messier pay tribute to the De Havilland Organisation, and are proud to be associated with this memorable triumph of British aircraft engineering.

ROTOL

ROTOL LIMITED · GLOUCESTER · ENGLAND

Lucas in the B.O.A.C.

COMET 4 DE HAVILLAND JETLINER

The *Rolls-Royce* Avon-powered Comet 4 is fitted with Lucas Fuel and Combustion Systems.

Fuel and Combustion Systems for Gas Turbine Engines

JOSEPH LUCAS (GAS TURBINE EQUIPMENT) LTD., Birmingham and Burnley
LUCAS-ROTAX (AUSTRALIA) PTY. LTD., Melbourne & Sydney, Australia
LUCAS-ROTAX LTD., Toronto, Montreal and Vancouver, Canada

LUCAS

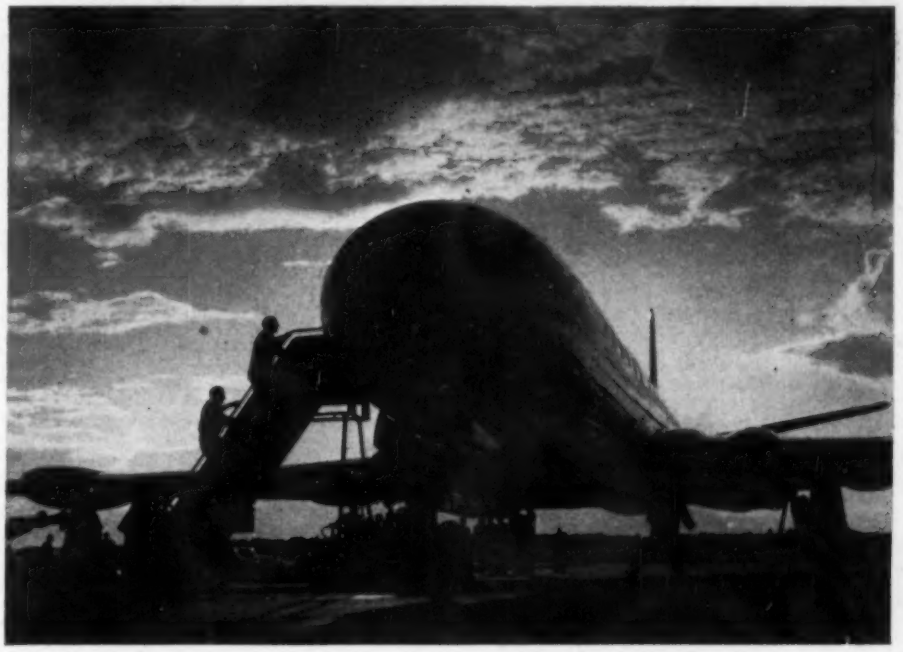
A TRIP TO NEW YORK (cont. from page 658)

full, with the outer wing-tanks still untouched. London was nine flying hours distant, and the piston-engined airliners which had left after us were probably still roughing it below the 23,000ft cloud-tops somewhere out over the Maritimes.

Footnote: Briefly discussed in last week's *Flight*, the flight-planning system evolved by B.O.A.C. for transatlantic Comet 4 operations is of particular interest and—as the outcome of 30,000 hr of jet operations—relatively simple. Briefly, fuel is allowed for (1) cruise-climb flight to overhead destination at cruising height; (2) a continuation of that cruise-climb and a descent to 1,000ft over the alternate; (3) a minimum fuel reserve of 5,000 kg—worth about 1¼ hr holding at 20,000ft (at a 55 kg/min fuel consumption at that height).

The penalties incurred by deviating from this idealized flight plan are available to the pilot in tabular or graphic form. He is able quickly to assess the fuel penalties of—for example—having to make stepped climbs instead of a cruise-climb, with steps varying in height between 1,000ft and 4,000ft; being obliged to carry out a constant-height cruise; encountering winds stronger than forecast; having to descend to 20,000ft—or 1,000ft—overhead destination instead of cruise-climbing on to alternate; and so on. All these adversities are covered by a fuel reserve which depends on the sector and which is a minimum of 5,000 kg. Initially at any rate, and when payloads permit, full tanks will be uplifted on the more critical sectors—i.e., London - Gander and Keflavik - New York.

B.O.A.C. hope to operate one-stop services westbound and through services eastbound on a high percentage of occasions throughout the year. Payloads are at present conservatively estimated at 12,000 lb in the summer and 10,000 lb in the winter.



This de Havilland photograph shows a production Comet 4 being prepared for delivery to B.O.A.C. To-date four aircraft have been delivered, the first on the contract date and the others well ahead of it

Contributors to the Comet 4

The following names of suppliers of equipment, finished parts, raw materials and castings and forgings used in the construction of the Comet 4 have been provided by the manufacturers of the aircraft:—

Equipment Suppliers

Airscrew Co. and Jicwood, Ltd.; Air Service Training, Ltd.; Automotive Products Co., Ltd.; Avica Equipment, Ltd.; Avimo, Ltd.; Barnet Instruments, Ltd.; Belling and Lee, Ltd.; British Electric Resistance Co., Ltd.; British N.S.F., Ltd.; British Paints, Ltd.; British Oxygen Aro Equipment, Ltd.; British Ropes, Ltd.; British Thomson-Houston Co., Ltd.; Camerer Cuss, Ltd.; Cannon Electric, Ltd.; Chelton (Electrostatics), Ltd.; de Havilland Propellers, Ltd.; E. K. Cole, Ltd.; Dowty Nucleonics, Ltd.; Dunlop Rubber Co., Ltd.; Films and Equipment, Ltd.; Flight Refuelling, Ltd.; General Electric Co., Ltd.; Graviner Mfg. Co., Ltd.

Hellerman Electric, Ltd.; Hendrey Relays, Ltd.; Honeywell-Brown, Ltd.; Hymatic Engineering Co., Ltd.; Inferation, Ltd.; Lancefield Aircraft Components, Ltd.; Marconi's Wireless Telegraph Co., Ltd.; Marston Excelsior, Ltd.; Mechanism, Ltd.; Metalastik, Ltd.; R. W. Munro, Ltd.; Murphy Radio, Ltd.; Negretti and Zambra, Ltd.; Normalair, Ltd.; Palmer Aero Products, Ltd.; Peto and Radford; Pilkington Bros., Ltd.; Plessey Co., Ltd.; R. B. Pullin and Co., Ltd.; Pyrene Co., Ltd.; Pyrotenax, Ltd.

Rist's Wires and Cables, Ltd.; Rolls-Royce, Ltd.; Rotax, Ltd.; Rotol, Ltd.; Sangamo Weston, Ltd.; Saunders Valve Co., Ltd.; Shell-Mex and BP, Ltd.; Siebe Gorman and Co., Ltd.; Simmonds Aerocessories, Ltd.; Smiths Aircraft Instruments, Ltd.; SPB, Ltd.; Stanley Electric, Ltd.; Static Condenser Co., Ltd.; Teddington Aircraft Controls, Ltd.; Teleflex Products, Ltd.; Thermal Controls, Ltd.; Thermotank, Ltd.; Thorn Electrical Industries, Ltd.; Triplex Safety Glass Co., Ltd.; Trix Electrical Co., Ltd.; Turner and Savage, Ltd.; Ultra Electric, Ltd.; Venner, Ltd.; Vickers-Armstrongs, Ltd.; Walters Electrical Mfg. Co., Ltd.

Finished-part Suppliers

E. S. Aston and Co., Ltd.; B. Attewell and Sons, Ltd.; Aviation Developments, Ltd.; Bell's Asbestos and Engineering, Ltd.; Birmingham Guild, Ltd.; British Insulated Callenders Cables, Ltd.; Bushing Co., Ltd.; H. Comoy and Co., Ltd.; Connolly Bros. (Curriers), Ltd.; Cope and Timmins, Ltd.; Crane Packing, Ltd.; Dart Spring Co., Ltd.; Dowty Seals, Ltd.; Edinburgh Weavers, Ltd.; T. F. Firth and Sons, Ltd.; Formica, Ltd.; Hall and Hall, Ltd.; Herts Rubber Co., Ltd.; High Tension Wires, Ltd.; Imperial Chemical Industries, Ltd.; Insulation Equipment, Ltd.; William Jones, Clifton and Co., Ltd.; Kautex, Ltd.; Latex, Ltd.; Lion Spring Co., Ltd.; Midland Aeroquipment, Ltd.; Pianoforte Supplies, Ltd.; Renold Chains, Ltd.; J. W. Roberts; Geo. Salter and Co., Ltd.; Sorbo, Ltd.; Tenaplas, Ltd.; United Spring Co., Ltd.; Warerite, Ltd.; Jas. Williamson and Son, Ltd.

Material Suppliers

Light Alloy.—James Booth and Co., Ltd.; British Aluminium Co., Ltd.; High Duty Alloys, Ltd.; E. and E. Kaye, Ltd.; Northern Aluminium Co., Ltd.; Reynolds T.I. Aluminium, Ltd.

Titanium.—Imperial Chemical Industries, Ltd. (Metals Division).

Tungsten.—Tungum Co., Ltd.

Steel.—Brown Bayley Steels, Ltd.; English Steel Rolling Mills Corp., Ltd.; Thos. Firth and John Brown, Ltd.; Kiveton Park Steel and Wire Works, Ltd.

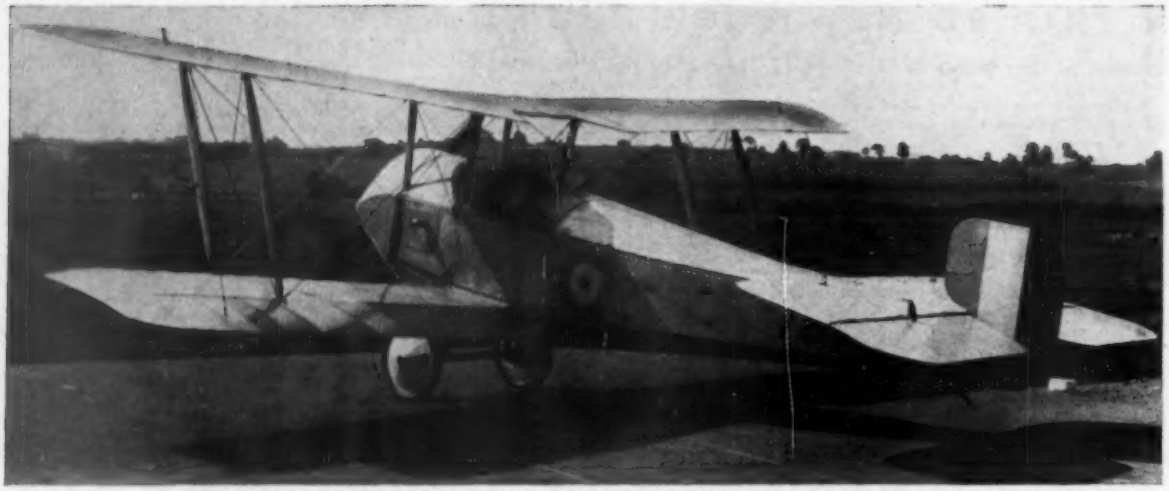
Steel Sheet.—Firth Vickers Stainless Steels, Ltd.; Samuel Fox and Co., Ltd.; Richard, Thomas and Baldwins, Ltd.

Suppliers of Castings and Forgings

Brett's Stamping Co., Ltd.; David Brown Foundries Co.; Cambrian Castings, Ltd.; Dudley Drop Forging Co., Ltd.; English Steel Forge and Engineering Corp., Ltd.; Fairey Aviation Co., Ltd.; High Duty Alloys, Ltd.; Hughes-Johnson Stampings, Ltd.; Kent Alloys, Ltd.; Light-Metal Forgings, Ltd.; H. J. Maybrey and Co. Ltd.; William Mills, Ltd.; Northern Aluminium Co., Ltd.; Southern Forge, Ltd.; Stampings Alliance, Ltd.; Sterling Metals, Ltd.; J. Stone and Co. (Charlton), Ltd.

Other Contributors

We learn that in addition to the above companies the following have also contributed to the Comet 4: Aircraft Materials, Ltd.; Delaney Gallay, Ltd.; Henderson Safety Tank Co., Ltd.; Walter Kidde and Co., Ltd.; Joseph Lucas, Ltd.; Mollart Engineering Co., Ltd.; Redifon, Ltd.; Robert Stuart (London), Ltd.; Walsh and McCrea (Halifax), Ltd.



The Bristol S.2A, a side-by-side two-seat development of the Scout D. Two were constructed

THE BRISTOL SCOUT

HISTORIC MILITARY AIRCRAFT No. 18 PART IV By J. M. BRUCE, M.A

A FEW Scouts had experimental engine installations; all were characterized by large spinners. At least three Scouts C were fitted with the 110 h.p. Clerget; they were Nos. 5554, 5555 and 5556. The first-mentioned was modified for the high-power engine when it was rebuilt after a crash at the Central Flying School. Of the three Clerget-powered Scouts No. 5555 was the most significant. After his return to the British and Colonial Aeroplane Co. in August 1915, Capt. Barnwell designed a number of aircraft, assisted by Mr. L. G. Frise. The designs were the T.T. (built as the T.T.A.), the F.3A project, the S.2A two-seat scout and the R.2A project.

It will not be inappropriate to include a note on the Bristol S.2A, for it was a development of the Scout D and embodied a number of Scout D components. The S.2A was one of many contemporary attempts to provide a scouting aeroplane with effective armament. When it was designed, no machine-gun synchronizing gear was available to Barnwell; consequently he designed the S.2A as a side-by-side two-seater in which the armament was wielded by the passenger.

The aircraft was little larger than the single-seat Scout, but its fuselage was twice as wide. When the first S.2A, No. 7836, appeared on the aerodrome it was promptly nicknamed "Tubby." Its engine was a 110 h.p. Clerget, installed in a fore-and-aft mounting. The first S.2A was completed in May 1916, the second in the following month. By that time the Vickers-Challenger synchronizing mechanism was available, and there was therefore no reason to proceed further with the development of the Bristol S.2A. In any case, its Clerget installation was not particularly successful and the engine gave trouble. The S.2As were used for training purposes. One was flown at Gosport with a 100 h.p. Gnôme Monosoupape engine in a modified cowling, and it is probable that the other flew at Rendcombe.

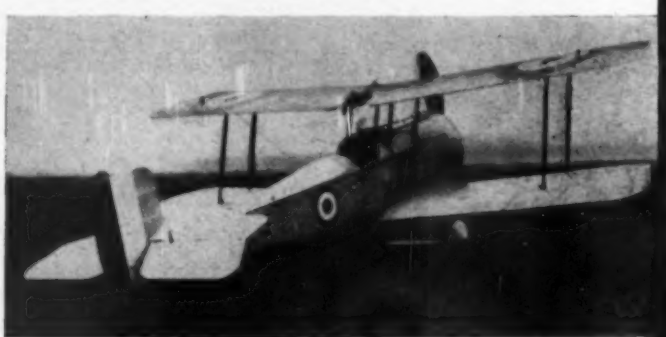
But the operational needs of the time were for faster single-seat fighters with effective weapons, and early in July 1916 Barnwell began to design the M.1A monoplane, an aircraft which was far ahead of its time. To its design Barnwell devoted that painstaking thoroughness which was so characteristic of him. He wanted to use a rotary engine in an installation which offered the lowest possible drag. He therefore installed a 110 h.p. Clerget (taken from one of the two S.2As) in the Scout C No. 5555 with a view to testing the power installation he had designed for the monoplane. The Clerget was somewhat larger than the 80 h.p. engines which were standardized for the Scout C; its short-chord cowling was therefore of greater diameter than the front mounting-plate on the fuselage and had to be tapered back. The airscrew was fitted with an enormous spinner in the shape of a segment of a sphere and this spinner covered almost the entire engine, leaving an annular aperture about 3in wide for the entry of cooling air. The spinner also had a central hole, 6in in diameter, but its primary function could only have been to facilitate the attachment of the spinner. Contemporary documents indicate that the spinner was, at the time, known by the more imposing designation of "spinning boss." With this power installation No. 5555 attained a speed of over 110 m.p.h. on test, and Barnwell proceeded with the design of the M.1A monoplane.

Scout No. 5555 was something of a hybrid. It began life as a Scout C, and in its modified form retained its original long ailerons. The mainplanes, however, were rigged with 3 deg of dihedral and the lower wings had the root cut-outs of the Scout D; the revised oil system was installed; and the final large rudder was fitted. A support for an obliquely mounted machine-gun was fitted on the starboard side and was stayed to the forward centre-section strut on that side.

A spinner of a different shape was fitted to No. 5556 but was not successful. It was conical, probably considerably more pointed than No. 5555's "spinning boss," but it distorted and became ellipsoidal at full engine speed, thereby causing severe vibration.

At least two other Bristol Scouts had large spinners. Scout D No. 8951, which had a 100 h.p. Gnôme Monosoupape engine, had a spinner similar in form to that of No. 5555 but of smaller diameter. The standard Monosoupape engine cowling was retained with its frontal opening slightly enlarged; the aircraft had the final large rudder, and was armed with a Lewis gun mounted on top of the centre section. It was possibly the most handsome Bristol Scout: certainly it had the best lines of all those which had spinners.

The other be-spinnered Bristol was the Scout D flown by Lt. Frank T. Courtney, but how it acquired its power unit is one of the minor mysteries of the war. It seems certain that Capt. Barnwell had nothing to do with the installation, which consisted of a 110 h.p. Le Rhône engine, propeller and spinner which had obviously belonged at one time to a Morane-Saulnier monoplane



A Scout D variant: this had Scout C wings, the finally enlarged rudder, and Lewis gun mounted on the centre-section

DH COMET 4

First Passenger Jet Liner across the Atlantic

Now the Atlantic is bridged by less than seven hours of quiet, smooth flying as the de Havilland Comet 4 inaugurates for B.O.A.C. the first regular passenger "pure jet" service between Great Britain and America.

Dunlop record with pride their association with this superlative British aircraft. Her tyres, wheels, brakes and brake controls, Maxaret anti-skid units and Maxivue windscreen wipers are all supplied by Dunlop Aviation Division.

DUNLOP

SUPPLIERS OF VITAL COMPONENTS FOR THE WORLD'S LEADING AIRCRAFT

cm/ml/124

B·O·A·C COMET 4

flies with

EKCO

search radar

In congratulating the Comet 4 on its outstanding success, Ekco take pride in the fact that this is yet another fine new airliner which will owe its extra comfort and safety to Ekco Search Radar. With its aid the Comet 4 'sees' storm clouds up to 120 miles ahead—in ample time for avoiding action to be taken.

Ekco were first in the world to manufacture Airborne Search Radar for commercial airline use . . . in this, as in so many other fields, Ekco are in the lead.

EKCO *ahead in* RADAR · COMMUNICATIONS · ELECTRONICS · NUCLEONICS
TELEVISION · RADIO · HEATING · PLASTICS FOR HOME AND INDUSTRY · LIGHTING

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THE BRISTOL SCOUT . . .

or biplane. The fixed cowling was, as on No. 5555, of greater diameter than the fuselage but had a chordwise camber instead of the more angular taper of the Clerget's cowling. In another place the author wrote of Lt. Courtney's Scout that ". . . the installation must have been a 'home-made' modification." In a letter to the author, Capt. Courtney subsequently wrote:—

"Your remark that my Bristol Scout D had a 110 Le Rhône installation which 'must have been home-made' was a sort of understatement. The bulge in the cowling knocked off any extra speed which the increased power might have provided, but the climb was wonderful."

When its operational days were over the Bristol Scout was widely used at training schools by both the R.F.C. and the R.N.A.S. The Central Flying School and various Reserve and Training squadrons of the R.F.C. had a few Bristol Scouts on their strength. Some of the greatest pilots of the war flew these Bristols of the training units, among them Bishop and McCudden.

The Bristol Scout was in fact the first tractor scout to be flown by McCudden, who had served his fighting apprenticeship on D.H.2s as a flight sergeant in No. 29 Sqn. He flew a Bristol for the first time at Orfordness ". . . and liked it so much that I plucked up enough courage to do six loops on it on my first flight." That was in March 1917, and soon afterwards McCudden became a Wing Fighting Instructor. On April 15, 1917, he went to Dover on instructional duties, where a Bristol Scout was to be allotted to him. After a few days he received his machine. Of it he wrote:—

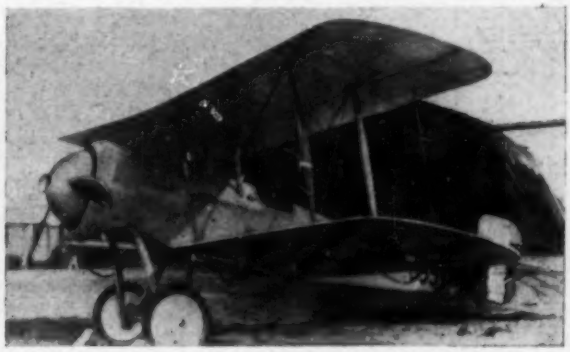
"Very soon the little Bristol Scout was ready, and I was very proud of it, as it was the only one on the station, and I remember that the pupils used to look at it and wonder if they would ever be expert enough to fly it. As a matter of fact the little Bristol was a most excellent flying machine, and quite easy to fly and land, though it was generally said that if a pilot could fly a Bristol well he could fly anything.

"The engine of my Bristol was an 80 h.p. Le Rhône, and, unlike the average Rhône, was a dud one. It gave 1,050 revolutions, climbing, flying level, and the same diving with engine on. However, it was just powerful enough to get me off the ground, and that was the main thing."

(To be concluded)

Scout C No. 5555 with 110 h.p. Clerget and spinner for Bristol M.1A engine installation

Left, Frank Courtney's Scout D (Morane-Saulnier spinner, 110 h.p. Le Rhône). Right, Scout D No. 8951 (100 h.p. Monosoupape and spinner)



Correspondence

The Editor of "Flight" is not necessarily in agreement with the views expressed by correspondents in these columns. The names and addresses of the writers, not for publication in detail, must in all cases accompany letters.

Helicopter Layout

MUDDLED thinking is rife on the subject of helicopter layout, particularly over the question of single or multiple rotors, some advocates of the former even maintaining that twin rotors are the counterpart of the biplane and similarly doomed to extinction! Very little reflection suffices to indicate the superficiality of this "argument," for the main disadvantage of the biplane, higher induced drag, does not enter into the equation in the case of helicopters.

It may be that the various types now existent all have sufficient virtue to warrant their continued existence, but in this case it is suggested that their rôles may become more specialized.

For the transport of passengers and freight between well separated points (say 100-500 miles) at which VTOL is required the claims of the powered autogyro such as the Rotodyne are strong. The high fuel-consumption of tip jets is acceptable for short periods, especially as these confer lightness and simplicity to the rotor and abolish the torque problem. But when long periods of slow flying or hovering are involved it would seem that the shaft-driven helicopter will hold its ground.

Shaft drive, however, involves torque and this must be compensated. It is interesting to note that the conventional anti-torque tail rotor adopted for single-rotor piston-engined helicopters has been continued with the advent of the gas turbine; the alternative attractively light and simple solution of using the residual momentum of the efflux gases appears to have been rejected. Presumably there must be very strong reasons for this, since the anti-torque rotor, apart from its complexity, weight, drag and expense, also absorbs a considerable fraction of the total power output. This type of helicopter is, perhaps, cheaper than the equivalent twin-rotor type and it also possesses exceptional manœuvrability.

The case for the twin (or multiple-twin) rotor shaft-driven helicopter depends principally on the elimination of torque (by contra-rotation) without loss of power. This should confer a better hovering performance than that of the conventional single-rotor helicopter with the same engine(s). It is therefore somewhat surprising that the Royal Navy should have cancelled an order for twin rotors in favour of one for single rotors, since slow flying and hovering are obviously major requirements, particularly for anti-submarine operations.

To sum up, it is suggested that helicopter rôles should be apportioned broadly as follows: (1) Conventional single rotor shaft drive—light communications. (2) Twin-rotor shaft drive—where the accent is on hovering and slow flying performance. (3) Rotodyne type—VTOL transport.

It would be interesting to hear the views of the experts.

Nicosia, Cyprus. F. P. U. CROKER.

A Winched-down Helicopter

YOUR correspondents "Cyberneticist" and Mr. A. B. Knight suggest the winching down of helicopters in letters to *Flight* published in the October 3 issue.

I believe that one of the first—I'd hate to tag anything a real "first" after seeing some of the recent correspondence about Col. Cody—uses of the winch for helicopter landings was in connection with sea trials and use of the Flettner helicopter in the German Navy in World War 2. During an interview with Mr. Anton Flettner several years ago, he showed me a sequence of photographs of this operation. It was recommended practice for anything but a flat calm, and was intended to keep the heli-

"Re-designed" Siemens-Schuckert D1 (see letter from H. J. Nowarra)

CORRESPONDENCE . . .

copter from being damaged by the abrupt rise of the ship under it. The pilot approached above the altitude of maximum pitch of the ship, and let down a cable which was secured to a winch. Under positive lift, the helicopter was winched down.

The technique was ingenious and—even better—practical. It worked and solved one of the more annoying problems for the pioneering helicopter designer.

Geneva. DAVID A. ANDERTON.

Open-fuselage Model Preferred

(From Sir William P. Hildred, C.B., O.B.E., director-general, I.A.T.A.)

ABSENCE at the Cannes Traffic Conference prevented me seeing promptly Roger Bacon's amusing reference (*Flight*, September 26) to my cycling habits.

I will answer his question: I have no hesitation in saying that the nauseating basket shown in his photograph would not only offer wind resistance sufficient to quadruple my operating costs per capacity ton-mile, but would also destroy the only thing that makes me ride a bicycle, and that is my ability to see the country through which I go—and to enjoy it as you cannot do from a car, from an aeroplane, or from anything other than horseback or a push bicycle.

I don't quite know why Roger Bacon says, "Careful, Sir William." Have I forgotten something about laminar flow, and is it the case that, fitted with this strange device, I should glide through the air with the greatest of ease? Even if I did, I should still want to see the country.

London, W.1. WILLIAM P. HILDRED.

Quick Re-design

AT first glance one might think that the biplane shown in the enclosed photograph [reproduced above—Ed.] is a French Nieuport 11 or 17 curiously modified. But it is quite a different fowl—actually, a Siemens-Schuckert D I in a late stage of its development. The odd form of the wings, however, was *not* normal. This World War 1 aircraft, used for training by a naval unit in Flanders, had been flown by a pilot who encountered a little bad luck on landing. A gust tipped his machine on its port wing just before touch-down; he pushed the stick the other way, and the starboard wing touched, with the result seen here.

Incidentally, another copy of the Nieuport Scout was built, by the Euler works in Frankfurt.

Berlin, NW.21. HEINZ J. NOWARRA.

Shock-wave or . . . ?

I WAS very interested to read the letter [October 10] from your correspondent Mr. T. N. Simpson, concerning the apparent shock-wave phenomenon that he recently witnessed at R.A.F. Odiham.

It immediately brought to my mind the several occasions on which I have observed a high-flying jet aircraft with what appeared to be a shock-wave preceding it along the same course. It usually involves a B-47 (although I have seen an F-100 in the same position) flying at about 35,000-40,000 feet in a clear sky. In front of the aircraft, and on the same course, a line of a darker blue than the surrounding sky stretches for about a mile. Although the aircraft may subsequently turn off its course, the line continues to remain in the same position for about two minutes afterwards. The distance between the end of the line and the nose of the aircraft when it is flying straight remains roughly constant.

Ipswich, Suffolk. M. P. HARRIS.

Aviation Incentive

I HAVE just read with very great interest an article in your Farnborough Review issue (Sept. 12) about *Popular Flying in the U.S.A.*, by Bob Whittier.

The part which I think is most interesting reads thus: ". . . the C.A.A. is acutely aware of the shortage of trained pilots . . . and has initiated an Aviation Incentive Movement for the purpose of encouraging young men to choose careers in aviation."

What an enlightened outlook! Why can we not have the same attitude? Instead, apart from the fact that flying is absurdly expensive, the Ministry seem to arrange everything to frustrate, impede and irritate the budding airline pilot.

I have deep personal experience of this, having been struggling to get a commercial licence for the past four years—the end being almost in sight, thank goodness.

There must be thousands—and I say that without any feeling of wild exaggeration—of potential pilots in this country who will never see the inside of an aeroplane.

I think it a tragedy that such a state of affairs is allowed to exist. After all, flying began because private individuals were interested enough, keen enough and had vision enough to see it through. It seems a great pity to stifle the grass roots of flying; maybe it will take another war to make some people realize that it's a good thing to have a force of pilots and mechanics, etc., just for the picking.

Stockport, Ches. R. C. ATKINSON.

From a correspondent, "Ignem Mortemque" (R.A.F. Station Manby) comes this photograph of a World War I rotary engine which, he says, can still be seen in Sanctuary Wood on the Ypres battlefield. The condition of the cylinder finning suggests that it may well have been there since 1915 and not simply added as a museum-piece at some time in later years

Pioneer Aerobatics

I FEEL that Mr. Dorman (unintentionally, no doubt) takes unto himself undue authority when he says [Correspondence, October 3] "I've little doubt that Pégoud was the first to loop. I devote a chapter to this in my *Fifty Years' Fly-past.*"

How can one accept that authority when he, in that very chapter, refers to "Armand" Pégoud? On the same page he attributes the first aerobatic display to Buc. Should not this be Juvisy?

I treat the book in question with the greatest reserve, since I once used it as an authority and gave Mrs. Griffith Brewer as the first Englishwoman to fly in an aeroplane!

London, W.1. BELTANE.

FORTHCOMING EVENTS

Oct. 27. R.Ae.S.: "The Bloodhound," by D. J. Farrar.
Oct. 28-29. AGARD Assembly, Copenhagen.
Oct. 29. R.Ae.S. Graduates' and Students' Section: Film Show.
Oct. 29. Kronfeld Club: "Aircraft at Leszno, 1958," by Peter Brooks.
Oct. 31. Surrey Flying Club: Annual Dinner and Dance.
Nov. 3-7. Kronfeld Club: Exhibition of Paintings of Gliders and Light Aeroplanes.
Nov. 4. R.Ae.S.: "The Spectre Rocket Engine," by W. N. Neat.
Nov. 5-7. Institute of Welding: Annual Dinner and Autumn Meeting.
Nov. 7. Association of British Aero Clubs and Centres: Annual Dinner.
Nov. 7. R.Ae.S. and Helicopter Association: "Development of the Fairey Rotodyne," by Dr. G. S. Hislop.
Nov. 8. D.H. Technical School Old Boys' Annual Dinner.
Nov. 11. R.Ae.S.: "Boundary Layer Control," by Dr. J. Williams.
Nov. 11. R.Ae.S. Graduates' and Students' Section: "The Air Transport Auxiliary," by Sir Gerard D'Erlanger.
Nov. 12. Kronfeld Club: "The Early Days," by F. N. Slingsby.

R.Ae.S. Branch Fixtures (to Nov. 6):—Oct. 29, *Christchurch*, "50 Years of Aviation," by G. Errington; *Gloster and Cheltenham*, "Astronomical Research and Space Travel," by A. F. Collins; *Hatfield*, "Recent Developments in Aircraft Casting Manufacture," by R. W. Eade; *London Airport*, brains trust; *Hereford*, "Landing Hazards on the Moon and Use of Space Stations," by A. F. Collins; *Weybridge*, "History of the Supermarine Organization," by A. N. Clifton. Oct. 30, *Belfast*, "Applications of High Nickel Alloys in the Aircraft Industry," by W. H. Featherstone. Nov. 3, *Cheltenham*, "Instruments for Guided Flight," by G. G. Roberts; *Derby*, Third Sir Henry Royce Memorial Lecture; *Henlow*, Second Trenchard Memorial Lecture. Nov. 4, *Luton*, "Guided Flight," by L. H. Bedford. Nov. 6, *Bristol*, "Helicopters," R. Hafner; *Isle of Wight*, annual dinner.

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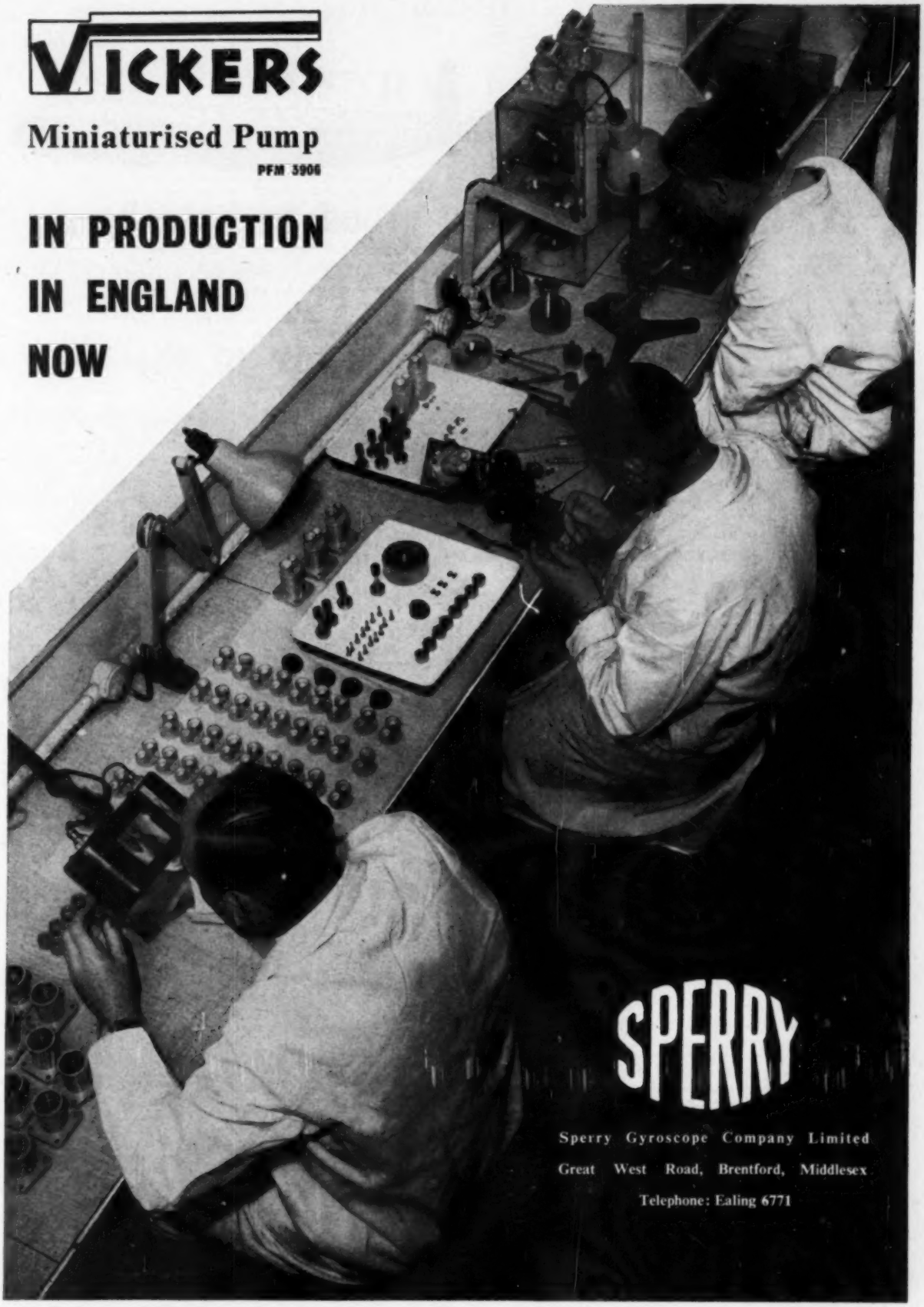

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By Our Air Correspondent

TO enable it to deal with the enormous task of training 130 crews to fly the 19 Comet IV jet airliners which it has ordered from de Havilland, B.O.A.C. is buying a ground simulator which will reproduce every condition of flight, even the gentle cockpit noise from the Comet's four Avon engines.

The simulator is being built by Redifon Ltd., specialists in this work, and it is hoped that it will be in operation in the early spring.

It will cost about £250,000—about the same as the simulator used to train Britannia crews—but it will save money by freeing Comets to carry passengers, not training crews. It will also be used for checking experienced pilots at appropriate intervals.

The electronics, which operate the simulator, occupy a sizeable room. They can reproduce any desired set of circumstances in the imitation flight deck from the effect of a power loss on take-off to that of a high-speed stall.

The flight deck will be a replica of that in the Comet IV, and will be in use day and night except for maintenance periods.

The men who are trained in the simulator will eventually fly the superb new aircraft not only across the Atlantic but also to Australia, South Africa and the Far East.

Extract from "The Observer" August 31st, 1958.

158R

The new Dunlop service station at London Airport, referred to below

THE INDUSTRY

Dunlop Service at L.A.P.

OPENED on Thursday of last week, the new Dunlop service station at London Airport is said to be the biggest tyre depot at any airport in the country. Built on the perimeter road at Hatton Cross, it has a storage space of 177,000 cu ft and can hold up to 2,000 aircraft tyres. It will also act as a base for Dunlop service engineers.

Stocks will cover American as well as British sizes and an exchange service will be operated whereby any airline can obtain a replacement tyre in return for a tyre given in for remould. A bonded store has been incorporated which will eliminate the delays normally associated with import/export procedure. Minor tyre repairs can be effected on the premises.

The new depot will not only stock tyres but also the various items of Dunlop equipment supplied to the aircraft industry, including brakes, wheels, de-icing equipment, Maxivue windscreen wipers, flexible hose, and actuating valves for hydraulic and pneumatic systems.

Napier Managerial Posts

AS briefly recorded last week, three appointments to managerial posts have been announced by D. Napier and Son, Ltd. They are those of Mr. W. E. Hampton, A.F.R.Ae.S., as deputy commercial manager (aviation); G/C. M. Lowe, C.B.E., as aviation sales manager (U.K. and Europe); and Mr. A. G. Shove, A.F.R.Ae.S., as aviation sales manager (overseas).

Mr. Hampton *G/C. Lowe* *Mr. Shove*

Mr. Hampton, who in his new post will be responsible to the commercial manager (Mr. R. M. Hilary) for the sales promotion of Napier aviation products and for the direction and administration of the aviation sales department, joined the company in March 1955 as aviation export representative. He had previously had wide experience in civil aviation, having been with the pre-war Civil Aviation Department of the Air Ministry and with B.O.A.C. during the war, and taken part in the 1930-31 British Arctic Air Route Expedition to Greenland as second pilot and engineer in charge; he was also second-in-command, chief pilot and engineer on Mr. J. R. Rymill's British Grahamland Expedition to the Antarctic in 1934-37.

G/C. Lowe served with the R.A.F. before and during the war, retiring in 1953 with the rank of group captain; and Mr. Shove, who completed an Airspeed Aeronautical College premium apprenticeship in 1939, was with Airspeed and Blackburn and General Aircraft before joining Napier this year.

Improved Tyre-life

ILLUSTRATED here is a ribbed tyre of a type now being fitted to Hawker Hunters. The Firestone Tyre and Rubber Co., Ltd., state that in the early days the Hunter was hard on tyres, averaging only seven landings per tread. Later, changes in specification and a slightly different tread improved this performance to something of the order of 30 landings. Now, they add, the Ministry of Supply has published figures showing that the Firestone mainwheel tyres (29×6.25-16 14 PR, nylon) fitted to many of these aircraft are averaging well over 50 landings per tread.

Steel Tube Production

STAINLESS-STEEL tubing for aircraft fuel and hydraulic lines will be produced in large quantities in a new gas-fired roller-hearth annealing furnace recently installed by Birlec, Ltd., in the new stainless-steel mill of Talbot Stead Tube Co., Ltd., Walsall.

A new electronic control system has been incorporated and considerable use has been made of Warner electro-magnetic brakes and clutches (made by Westool, Ltd.), to provide overall remote control.

The furnace, which can turn out one ton of steel per hour, comprises four sections: a loading table, furnace chamber, spray quench booth and unloading chamber. It is remotely controlled from three control desks, supplied by Teledictor, Ltd., situated along its length.

IN BRIEF

An agreement has been reached between Marconi's Wireless Telegraph Co., Ltd., and Jugoimport, a Yugoslavian import agency, for the manufacture in Yugoslavia of Marconi sub-miniature automatic direction finders, type AD722.

* * *

Mr. R. W. Devereux has been appointed sales manager of Warwick Production Co., Ltd., which he joined last year after service with various other companies of the Almin Group. He is the son of the late Col. W. C. Devereux, founder of the group.

* * *

Mr. R. F. Webb, B.Sc., Ph.D., formerly a lecturer in Natural Sciences at Cambridge University and a Fellow of Trinity Hall, Cambridge, has joined the staff of CIBA (A.R.L.), Ltd., Duxford, where he will direct the activities of a number of specialist groups engaged in long-term research on new plastics.

* * *

Mr. C. G. Longford, B.Sc., A.F.R.Ae.S., formerly with the Gloster Aircraft Co., Ltd., as chief flight-test engineer, has joined the Board of Wynn Developments, Ltd., Staverton Aerodrome, Gloucester, as technical director. This company has been formed to carry out research and development for aircraft, marine and industrial installations.

Brig. L. L. Cross, C.B.E., who (as briefly recorded in a news-item last week) has been appointed public relations officer to the Hawker Siddeley Group. He is retiring from the Army after being Chief of Public Information at SHAPE since 1954. From 1946 to 1950 he was Deputy Director of Public Relations at the War Office, becoming Deputy Chief of Public Information at SHAPE in 1951

Stewart Aeronautical Supply Co., Ltd., have been appointed official stockists of connectors and aircraft components for the aircraft components division of Thorn Electrical Industries, Ltd.

* * *

Export Packing Service, Ltd., having consolidated their packaging activities at a high pitch of efficiency within their Banbury and Sittingbourne factories, are to close down their Cardiff works at the end of the year.

* * *

A general-purpose analogue computer designed and built by Short Brothers and Harland, Ltd., is to be installed in the Department of Electrical Engineering at McGill University, Montreal. It will be used for research on electrical circuit design and control system analysis.

* * *

Mr. George Campbell, B.Sc., A.R.C.S.T., F.R.I.C., A.M.I. Mech.E., has been appointed general manager of the chemical and metallurgical division of the Plessey Co., Ltd. He was previously technical manager and deputy general manager of the company's Towcester plant.

CIVIL AVIATION

In the melancholy shadow of a Cocooned Constellation, B.O.A.C. ground engineers last week voted unanimously to continue the unofficial strike that threatened to rob the Corporation of its new-found jet supremacy across the North Atlantic. In the background is the grounded Stratocruiser fleet

I.A.T.A.: CANNES TO DELHI

TODAY, tomorrow and on Sunday, delegates of the 85 member airlines of the International Air Transport Association will be making their way to New Delhi, where the annual general meeting of I.A.T.A. is to be held. The host-airlines are Air India International and the Indian Airlines Corporation, the overseas and domestic carriers of the country chosen this year as the venue for the A.G.M. It is customary for the Association to elect a president from one of the host airlines at each A.G.M.: at the start of the fourteenth conference, on October 31, Sñr. Tomás Delgado, chairman of Iberia, will step down in favour of Mr. J. D. Tata, chairman of Air India.

In New Delhi next week will be gathered the most senior executives of the world's airlines, and there also will be gathered the representatives of many of the world's aircraft manufacturers. The formal business of the conference is to install the new president, to set the seal on the year's activities and to formulate policy for the following year. But the occasion is one of the few on which airlines can also enjoy their association socially.

The airlines' greatest concern is still their dwindling profit margin, now down to a paltry 1 per cent of revenue. Remedies have not been easy to find; broadly speaking airlines have found themselves split into two camps, some wishing to see existing air traffic pay more, others anxious to penetrate new markets by offering cheaper travel. The problem of compromise was shown by the difficulty of agreeing to a suitable North Atlantic fare structure—introduction of a three-tier fare level brought I.A.T.A. as near as it has ever been to an open disagreement. It took a "breathing spell" between conferences at Miami and Paris in the autumn of last year before the major unifying force in I.A.T.A.—the need to keep decisions on airline matters in the hands of airlines and not of governments—was seen to prevail over opposing viewpoints. The composite meeting of traffic conferences that began last month had further thorny fare problems to solve. An extension of economy-class fares on to routes other than the North Atlantic, and the introduction of differential fares for slower services were the two main subjects to be discussed. At the time of going to press no clear-cut decision had yet emerged on either point. Airlines such as K.L.M. that wish to eliminate the tourist-class and concentrate on first- and economy-class travel appear to be outnumbered by those in favour of the three-tier structure and those against an extension of economy class travel. PanAm and T.W.A. are opposed in their views on differential fares, while the European carriers are also divided, the Mediterranean airlines mostly preferring a differential while their northern neighbours (except for B.E.A.) are favouring the same fare levels for all aircraft types. Air France wishes to compromise by resorting to an "experimental" differential, but the most likely solution appears to be an acceptably marginal differential, coupled with the replacement of tourist-class by economy class, and an increase in first class fares.

VISCOUNT MYSTERY

A YEAR ago yesterday—on the afternoon of October 23, 1957—a B.E.A. Viscount 802, G-AOJA, crashed at Nutt's Corner, Belfast. The conclusion reached by the court of inquiry, and published last week, was that the crash remains "a wholly unexplained calamity."

The aircraft was being positioned from London to Belfast to carry out a charter flight. On board were a crew of five and two passengers (a B.E.A. employee and his wife). After an uneventful flight the pilot began a G.C.A. talk-down but then decided to overshoot when less than three-quarters of a mile from touchdown. A few seconds later the aircraft crashed within the airport boundary, about 1,000ft to the south of the western end of the main runway. All seven occupants lost their lives.

Being unable to find "any explanation of this disaster based upon pilot error," the court examined the possibility of loose objects having found their way into the control mechanism. Discovery of a damaged screwdriver in the wreckage had led to some speculation, but the court decided that "it would be wholly wrong to allow suspicion about this screwdriver to rear its head . . ."

Three recommendations are put forward: a more vigilant system should be devised to eliminate the possibility of tools or other objects being left loose in an aircraft; improved security methods are needed to prevent the loss of tangible evidence (in this instance, the screwdriver had been removed from the wreckage by an airport employee); and finally, in view of a conflict of evidence as to whether or not the approach lights were on at the time of the accident, the person responsible for switching such lights on or off should keep a record of the times at which these duties are performed.

A WORTHY EFFORT

JUST over a month ago *Flight* put forward the case for accelerating the publication of British airline monthly statistics, if necessary by the use of estimates, to present a much needed up-to-date picture of the industry.

Those in the Ministry of Transport and Civil Aviation responsible for these statistics deserve warm congratulation for the new series of provisional estimates that are now being released. To issue August figures by mid-October is a record that is matched by no other comparable air transport power.

These provisional figures are appropriately encouraging. Compared with the dismal record in the spring, the summer months tell a story of constant improvement: traffic in June was 9 per cent higher this year than in 1957 and the equivalent figures for July and August were 11 and 12 per cent. Load-factors also improved, reaching an average of 64 per cent in August.

The first Boeing 707 for American Airlines was on pre-delivery when this photograph was taken on October 5. The Boeing caption describes the aircraft as taking off from the Transport Division facility at Renton prior to delivery to the Commercial Preflight Centre in Seattle, but full flap and lack of smoke suggest that, in fact, it is landing.

RECORD PROFITS?

To reduce costs on medium haul routes, it makes sense to utilise the airliner with substantially lower operating costs than its competitors. This airliner is the new Vickers Vanguard! Lower costs are essential if fares are to be reduced to the level needed to attract the additional traffic which can ensure intensive utilisation and profitability.

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SW/64

CIVIL AVIATION . . .

Qantas have appointed Capt. Lewis Ambrose to be their general manager for the U.K. and Europe. Between 1952 and 1954 Capt. Ambrose served as the airline's London manager, and during the past four years he has been manager of Q.E.A.'s Far East routes

FIGHT OVER STOP-OVER

SIGNIFICANTLY, PanAm and T.W.A. have not joined the American domestic trunk carriers in objecting to the application put forward by Qantas to carry international traffic on sectors within the borders of the U.S.

The Qantas application puts America's two transatlantic carriers in an awkward position. If it were granted it would damage their domestic kith and kin and would also weaken their competitive position *vis-a-vis* the Australian carrier. But to slam the door in the face of Qantas would be to invite immediate retaliation by those countries that allow PanAm and T.W.A. to carry stop-over traffic on their foreign services. Faced with such a dilemma, they find it expedient to leave the domestic trunks to do battle with Qantas.

Qantas have no intention of entering the U.S. internal market. The only right sought is that of carrying certain traffic over two sectors of their network that lie within the U.S. (Honolulu - San Francisco and San Francisco - New York). The only passengers involved would be those who travel on Qantas' transpacific or transatlantic services, break their journey at one of the above three gateways, and then travel on to one of the other points in the U.S. served by Qantas. Passengers stopping over at one of the three gateways before travelling outward from the U.S. on a Q.E.A. service are also included in the application.

Qantas's case is strengthened by the U.S. Government's reply given in an I.C.A.O. questionnaire, to the effect that classification of international traffic should be determined by initial origin and final destination of each journey.

JETS AND THE TRAVELLING PUBLIC

EACH year the Boeing Airplane Company, in conjunction with Time Inc., sponsors a study by the University of Michigan Survey Research Center into *The Travel Market*. In one section of the 1958 study the programme's director, Dr. John Lansing, describes his investigation last June into "Attitudes toward travel by jet plane."

The public are broadly divided in their attitude to jets, according to whether or not they have already flown. Of every ten adults who have on some past occasion used air services, no fewer than seven "would like to fly in commercial jets," and five of these consider that jets will be safer than piston aircraft ("fewer moving parts" was given as a major reason for this belief). Among those who have never flown, only three in ten would be prepared to fly by jets. The first of these two categories comprise 29 per cent of all persons interviewed (equivalent figure in 1955 was 24 per cent), but only 9 per cent of the total had flown within the previous twelve months.

A surprising discovery was the high degree of misconception regarding the advent of jet airliners. Among the non-flying section of the public only one in five realized that these aircraft would be in widespread service by 1960. While many of those interviewed believed that jets were already in operation, others were not expecting their advent in the coming decade.

UNTAPPED MARKETS

TUCKED away inside the latest annual report of the British Travel and Holidays Association are some unusually informative details comparing sea and air traffic to the U.K.

In only four markets have the airlines outstripped the shipping companies: of those tourists coming to the U.K. from the Colonies and Protectorates, almost twice as many fly as travel by sea; rather more than half the number of Britons returning home last year from residence abroad preferred to fly (31,000 as against 23,000 by sea); the number of Americans coming to Britain by air continued to rise last year, and at 152,000 is well above the figure for sea traffic (111,000); Switzerland is the only other important country which contributes less surface traffic than air traffic.

The two markets in which airlines continue to show up badly are Europe and the Dominions. About half-a-million foreign visitors came from Europe to the U.K. last year and of these only one in three chose to fly. With the remarkable exception (already noted) of the Swiss, the European visitors showing the greatest willingness to fly were the French and Dutch. Surprisingly few Germans—only one in four—chose air travel.

But a much larger potential market for airlines is to be found on the long Dominion routes. For every Canadian coming to Britain by air another comes by sea; two in every three Australians, South Africans or New Zealanders visiting this country choose to travel by sea. For those operators unsure where to find the traffic to fill the big jets, here surely is a place to look.

EAST GERMANY'S NEW TRANSPORT

THE first production Baade Type 152, destined for East German Lufthansa, should be completed by the end of 1959. According to *Aviation Week* six prototypes and three initial production aircraft are being laid down. The first prototype flew in June and is now undergoing its test programme. A second aircraft, completed the following month, will be used for structural testing and a third prototype will be used for engine testing. A fourth machine will be finished—but not furnished—by the end of May next year; and a fifth, which should be completed by the end of September 1959, will be completely equipped. A sixth prototype will be used for structural testing to destruction.

The programme for production 152s is that the first should be rolled out by the end of 1959 and the second completed by the end of March 1960, with the third following in July of the same year.

INDEPENDENTS FARE BEST

BRITISH airline statistics for last May suggest that the independents fared better this summer than the two Corporations. B.E.A.'s traffic increased by only 2.4 per cent over that of last year, while B.O.A.C. increased its loads by 6.5 per cent. In contrast to these meagre improvements, increases of 12.5 per cent on scheduled services and—most remarkable of all—46.8 per cent on inclusive tours were enjoyed by the independents.

The latter have also been more successful in tailoring capacity to fit load. While their overall load-factor on scheduled services shows a slight rise (56.7 to 57.2) compared with the figure for May last year, B.E.A.'s load-factor dropped from 64.6 to 57.4 per cent, and that for B.O.A.C. fell to 55.6 per cent (61.3 last year).

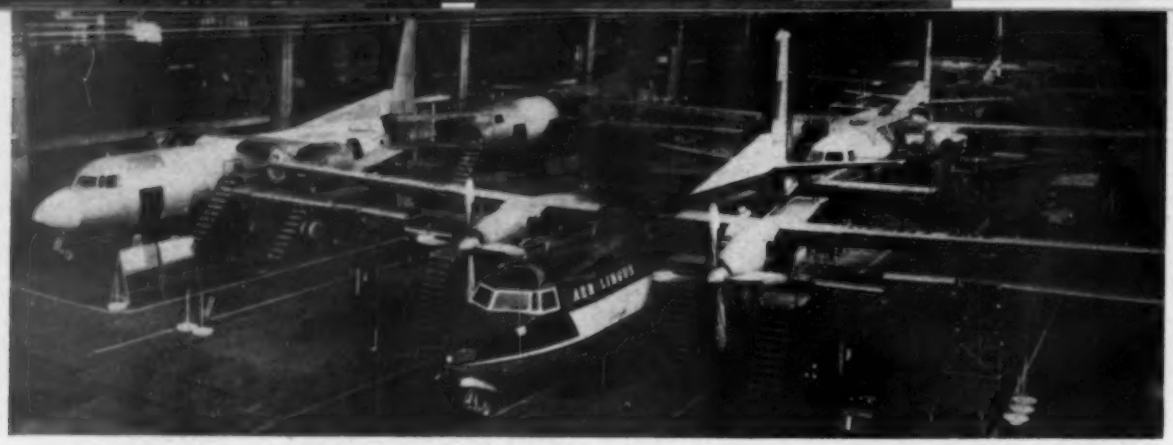
Capacity on the western routes operated by B.O.A.C. showed an increase of 49.2 per cent as against a rise in traffic of 29.1 per cent. On the Corporation's eastern and African routes capacity was increased by 1.8 per cent but traffic fell by 5.1 per cent.

B.E.A. suffered similarly. On international services, capacity increased by 18 and loads by 4 per cent. Capacity on domestic routes was increased by 6.0 per cent but passenger-miles were 2.7 per cent less.

Although domestic traffic carried by the independents was also down on last year (by 2.2 per cent), this fall was more than outweighed by an increase in international scheduled traffic of 16 per cent. As already noted, an even greater rate of increase was recorded against inclusive-tour traffic.

But these average figures for all the independents conceal wide variations in the experience of individual companies. Cambrian, as noted last week, have suffered a fall of 10 per cent in traffic. Britavia are also having difficulty in finding work for their fleet of five Hermes now that the Air Ministry is considering trooping tenders specifying DC-6As and Britannias. On the other side of the picture, Silver City traffic across the Channel is up by 60 per cent over last year (in the financial year ended September 30 no fewer than 50,000 cars were carried). Channel Airways have also enjoyed a remarkably good season, their traffic this year being estimated to have increased by 35-40 per cent, and as this trend continues, their Doves should soon be replaced by larger aircraft.

Troops disembarking at Stansted from a Britannia 307 on charter to the Air Ministry. Air Charter are operating this aircraft on four round flights to Christmas Island during October



Friendship production at Schiphol and Hagerstown is now in full swing; these photographs provide a comparison of Dutch and U.S. progress. Although the scene above is evidently not in working hours the orderliness of Fokker's assembly line is evident. Both Aer Lingus aircraft and the one for Braathens (second on the line) carry Dutch registrations. The impressive line-up on the left shows Fairchild's demonstration F-27, four for Piedmont and three for West Coast

CIVIL AVIATION . . .

LUCRATIVE AIRLINE INVESTMENT

AUSTRALIA'S publicly owned Trans-Australia Airlines have presented their annual report for 1957-58 under their official name of "The Australian National Airlines Commission."

After the imposition last year of a Customs duty on turbine fuel (6.3 pence per gallon), T.A.A.'s unit costs rose by 5 per cent from 33.4 to 35.0 pence per c.t.m. and all passenger fares (except on Darwin services) and freight rates were increased in December to maintain operations at a profitable level. But a net rise in revenue rates (3 per cent) and a slightly higher load-factor (65.8 per cent as against 65.1 per cent) were insufficient to match the rise in expenditure: net profits consequently fell from £A309,000 to £A283,000.

Such a slight setback must not mask T.A.A.'s healthy financial record. This organization shows the remarkable (for an airline) net return on capital of 7 per cent, and last year managed to sell £A11.6m worth of services on capital valued at £A4.4m—a capital turnover rate of 2½ (most airlines are happy to turn their capital over once a year). To finance expansion T.A.A.'s capital now has been raised to £A4.9m, and the Government has agreed to guarantee £A8m re-equipment expenditure.

The government receives an annual dividend payment of 5 per cent from its investment in T.A.A. Qantas, in which the government has invested almost twice as much (£A8.7m), pays a dividend of 4½ per cent.

Q.E.A. last year experienced similar conditions to T.A.A. Traffic rose by 8 per cent but profits fell. Rates and fares were improved by an average of 4 per cent, but load factor fell to 58.4 per cent (the first time for many years that this figure has been below 60). The level of unit costs was held at 44 pence per c.t.m., a rise in fuel costs and payroll being balanced by a reduction in depreciation charges. If the airline had not had to face a nine-day pilots' strike in April and a 200-mile diversion on the Kangaroo service during the Suez crisis the level of unit costs would certainly have been cut. As it was, the gap between revenue and expenditure narrowed and so profits were below expectation, falling from £A¼m to £A¼m.

Revenue at £A21.4m was almost twice the airline's total capital (including reserves, £A12.5m). The value of new assets has risen by £A32m since the airline was nationalized in 1947, and only £A12.5m of this has come from outside sources (£A10m additional capital, £A2.5m loans). No less than £A20m has come from the airline's own resources; £A12m from obsolescence, £A3m retained operating profits and £A4m capital profits.

T.A.A. and Qantas together provide an encouraging example of public enterprise that is really enterprising.

BREVITIES

PAN AMERICAN AIRWAYS have received qualified permission from the Italian authorities to use the Boeing 707 on services through Rome. The original plan was to start these services next Sunday, October 26.

* * *

Aerolineas Argentinas are planning to start scheduled Comet operations from B.A. to New York on May 4 next year.

* * *

Plans for a permanent London heliport at Battersea have been submitted by Rotorports, Ltd., to various borough councils and planning authorities.

* * *

K.L.M. have taken up an option on three DC-7Cs, bringing their fleet of these aircraft up to 15. Delivery will be completed before the end of the year.

* * *

Delivery of the first Lockheed Electra, to Eastern Air Lines, took place last week. Eastern expect to receive a further 11 aircraft this year and plan to start scheduled services on December 1.

* * *

Turkish Airlines are considering the purchase of F-27s. Trans-Pacific Airlines (Aloha) are also reported to be about to order two Friendships. Meanwhile, the two aircraft acquired by Wheeler Airlines are being offered for sale.

Garuda are reported to be about to order three unspecified American jet airliners.

* * *

Over £3m will be spent on improving Accra airport to allow Boeing 707s to operate through Ghana.

* * *

Capital suspended all services on October 16 because of a strike involving their ground engineers.

* * *

Pacific Western Airlines have withdrawn their application to operate scheduled transcontinental services across Canada.

* * *

Orders worth $15.6m (£5.6m) have been placed by the C.A.A. for installation of VORTAC equipment at a further 196 points in the U.S.

* * *

Under a revised partnership agreement between B.O.A.C. and E.A.A.C., certain Britannia 312 services between London and East Africa will be operated by B.O.A.C. on behalf of East African Airways.

* * *

A Super Constellation operated by L.A.V. crashed in the mountains north-east of Maracaibo while on a flight from Panama on October 14. There were no survivors among the 17 passengers and seven crew on board.

SERVICE AVIATION

Royal Air Forces and Naval Flying News

One of the crews of No. 617 Sqn., equipped with Avro Vulcan B.1s and flying from R.A.F. Scampton, which with other aircraft of Bomber Command provided part of the attacking force in the recent defence exercise "Sunbeam" (see this page)

S.A.C. Competition Results

SOME excellent performances were put up by the Valiants of R.A.F. Bomber Command which participated in the S.A.C. bombing and navigation competition last week at March A.F.B., Cal. In the result of the overall contest, W/C. S. Baker's team of four Valiants (one of two R.A.F. teams) was placed seventh in competition with 39 S.A.C. teams, winners being the 306th (B-47) Wing. The contest between the B-52s and the Valiants was won by the 42nd Bomb Wing with 1,417.6 points, the 93rd Bomb Wing being second with 1,389 while W/C. Baker's team had 1,379.2 pt—which put it into third place. S/L. R. W. Richardson's crew came third in the crew placings.

Specially good performances were put up on the final night of the contest (Thursday, October 16) by F/L. J. Cochrane, of W/C. Baker's team, who gained 323.6 pt, and F/L. D. Delaney of S/L. Richardson's team (310.2).

The squadrons represented in the R.A.F. detachment, which was commanded by G/C. L. M. Hodges, were Nos. 90, 138, 148, 207 and 214. The eight Valiants they flew were competing with 108 B-47s, 40 B-52s and eight B-36s. Serviceability rate of the Valiants was "extremely high," only one equipment failure being encountered in 24 sorties.

Exercise Sunbeam

AIRCRAFT of the R.A.F. and Fleet Air Arm and the U.S.A.F. based in the United Kingdom, and from the Belgian and Netherlands Air Forces and Nos. 2 and 4 Allied Tactical Air Forces, took part in Exercise Sunbeam last week. The exercise was designed to give practice to the U.K. air defence system under conditions to be expected in the early stages of a nuclear war, and during part of it there was a "fall-out" phase—Exercise Night Bird—in which the R.O.C. and the U.K. Warning and Monitoring Organization participated. This provided a new feature for such an exercise, as did the inclusion of the R.A.F. guided-missile station at North Coates, which exercised the complete weapon system up to the point of firing. (During three early phases it claimed 28 "kills.") A provisional final assessment of Sunbeam said that it indicated that "encouraging progress has been achieved during the past year."

Air Chief Marshal Sir Thomas Pike, who as A.O.C-in-C. Fighter Command directed the exercise, made it clear at a preliminary briefing that the effort was a big one—about 3,500 "enemy" aircraft attacking in ten phases spread over a three-day period of activity.

Fighter Command, as the defending element, employed its Hunter F.6s against the day attackers and for night operations the F.A.W. squadrons, all but three of which are now equipped with Javelins. Against these defences (including North Coates) a miscellaneous armada of aircraft was employed. Flying from the U.K. were Canberras, Vulcans and Valiants of Bomber Command, while from the U.K.-based U.S.A.F. came F-84s, F-100s, B-45s, and B-47s; the F.A.A. sent Sea Hawks, Sea Venoms and Vampires; and the R.A.F. contributed Vampires. From Europe came F-84s and RF-84s of 2nd A.T.A.F., F-100s, F-101s, CF-100s, Sabre 6s and RB-66s of 4th A.T.A.F., and U.S.A.F. B-47s based in Spain. In addition, aircraft of Nos. 2, 3 and 5 C.A.A.C.U.s (civilian anti-aircraft co-operation units) were employed to fly low-level attacks—not scheduled for fighter interception—against targets on the east and south coasts, for the benefit of Territorial Army L.A.A. units and coastal R.O.C. posts.

Provisional assessment of the early phases by Fighter Command Headquarters seemed to show that they had good cause for satisfaction, particularly as far as the day fighters were concerned; No. 111 Sqn., operating from Wattisham, claimed 31 kills, and No. 43 (from Leuchars) 29. The all-weather fighters, too, were fully engaged and "a most satisfactory proportion" of raiding aircraft was intercepted well out to sea—some as far as 130 miles from the British coast. An important feature of Exercise Sunbeam in this respect—Air Chief Marshal Sir Thomas Pike disclosed—was the use of a new system of obtaining early warning from NATO radars based on the Continent. As the C-in-C. explained, such early warning enabled Fighter Command not only to alert its own force but also to warn the deterrent.

Bomber Command's part in the exercise was well illustrated by a visit which *Flight* paid to R.A.F. Scampton, where No. 617 Sqn. (the re-formed "dam busters") is on its mettle to deserve the proud reputation so splendidly won by its wartime predecessors. As A.V-M. G. A. ("Gus") Walker, the A.O.C. No. 1 Group, explained in a briefing, while the exercise consisted of the penetration of U.K. defences on a broad front it was not economic to put V-bombers in the air solely for this task. The Vulcans of his group were therefore flying on after this operation to attack simulated targets. In the case of XH499 (in which we flew, captained by F/L. Thomas and with the squadron C.O., W/C. D. Bower, as navigator) and three other Vulcans from Scampton, this involved a round trip of some 2,400 n.m. and just over 5¼ hours' flying time. Of this period, something over an hour was spent in Exercise Sunbeam participation; the rest of the time was employed in routine training. Our Vulcan was not intercepted, and in a final Sunbeam communiqué it was stated that fighter pilots had found the V-bombers "the most difficult targets."

One of the three types of tactical fighter recently evaluated by the R.A.F. in the Aden Protectorate, this Folland Gnat Mk 1 (XN122) is seen being unloaded from a Blackburn Beverley at R.A.F. Khormaksar

SERVICE AVIATION . . .

No. 201 Sqn. Revived

AT a ceremony at R.A.F. St. Mawgan, Cornwall, on October 10 the number of No. 201 Sqn. was assumed by No. 220 Sqn. The former squadron, which received its standard in 1949, ceased to exist as an active unit last year when Sunderlands were withdrawn from R.A.F. service; but as it is the Air Council's policy to avoid the laying-up of squadron standards, No. 201 Sqn. has now returned to Coastal Command. The parade marking its re-inauguration was reviewed by the A.O.C. No. 19 Group, A.V-M. G. I. L. Saye.

Electronics Post

HAVING been A.O.C. No. 27 Group, Technical Training Command, since June last year A. Cdre. C. M. Stewart is to become Chief Electronics Officer at Fighter Command on December 1. He will succeed A. Cdre. M. K. D. Porter, who is leaving to take the 1959 I.D.C. course.

A. Cdre. Stewart has been a signals specialist since 1936 and one of his wartime appointments was that of Chief Signals Officer with No. 85 Group, 2nd T.A.F., a post he took up in 1944. He was mentioned in despatches the following year and also made O.B.E., being appointed C.B.E. in 1952.

C.A.S. at Nottingham

SEVERAL "firsts" made this year's Nottingham University Air Squadron annual dinner (held on Wednesday last week, October 15) a notable occasion. It was the first time the Chief of Air Staff, Marshal of the R.A.F. Sir Dermot Boyle, and the Principal of Loughborough Technical College (Dr. H. L. Haslegrave) had attended; and it was the first time the squadron had dined at R.A.F. Syerston—to which they may move their flying activities, although no official decision has yet been taken.

It was encouraging for Nottingham U.A.S. members to hear their squadron congratulated by the C.A.S. on its varied achievements—they had done 2,000 hours' flying without an accident; come a close second in the Reid Trophy competition; risen from 12th to 6th place in this year's Hack Trophy contest; and been runners-up for the Kingsley Wood Trophy.

Sir Dermot gave them some stimulating news about the R.A.F.'s continuing need for pilots, saying that its "greatest shortages" in the next ten years would be of pilots and aircrews. Whereas a year ago two-thirds of the flying had been done by short-service officers and a third by regulars, in 1970 only a sixth would be done by regular officers. The aeroplanes the R.A.F. had to fly in the future cost an enormous amount of money and had a tremendous military value; but the spirit was the only thing that really mattered; whether weapons were manned or unmanned, they still had to be operated by men.

S/L. W. D. Hooper, who has just completed a year in command of Nottingham U.A.S., was able to report not only the improvement in the squadron's Hack Trophy status but also that a larger-than-usual number—six—of squadron members who had gone down this year had joined the R.A.F., while five had gone into the aircraft industry and two into atomic research. He thanked the station commander at Syerston (G/C. J. H. L. Blount) for offering the squadron "these wonderful facilities" at short notice and gave a special welcome to Dr. Haslegrave.

The latter, who responded on behalf of the guests (among whom was Air Marshal Sir Richard Atcherley, A.O.C-in-C. Flying Training Command), paid a special tribute to the R.A.F.—speaking as "a humble civilian"—for the spirit of service it had generated and kept on giving. Both Loughborough College and Nottingham University, he added, welcomed their connection with the U.A.S. And in responding to the toast proposed to the squadron by the C.A.S., Cdt. Plt. A. G. Walton summed up the evening fittingly by saying that it had been "one of the most auspicious occasions" in the history of Nottingham U.A.S.

No. 69 Sqn. Reunion

THIS year's reunion of No. 69 Sqn. (1939-45) will be held in London on November 8. Those interested should write to Mr. J. Swift, 17 Atkinson Street, London, S.E.14.

A.V-M. R. B. Lees, the new S.A.S.O. at Fighter Command (this page, last week), entering a Hunter T.7 at R.A.F. Chivenor where he recently took a conversion course and where his son—F/L. R. Lees, seen with him—is a tactical instructor

Recent Postings

AMONG R.A.F. appointments recently announced by Air Ministry are the following:—

G/C.s E. G. Palmer to Rome, as Air Attaché; G. R. Gunn to Air Ministry, as Deputy Director, Medical Organization; J. R. R. Jenkins to H.Q., No. 90 (Signals) Group, as S.M.O.

Victor's Malta Record

A VICTOR from the O.C.U. at R.A.F. Gaydon flew from overhead Farnborough to overhead Luqa Airport, Malta, in two hours on October 14. Its average speed for the 1,310 statute miles was 655 m.p.h. The aircraft was captained by W/C. D. Iveson.

An official point-to-point record for a London - Valetta flight was set up last June by a R.N. Scimitar, which covered the 1,298 statute miles in 2 hr 12 min 27.2 sec at an average speed of 588.05 m.p.h.

IN BRIEF

Fighter Command air gunnery trophies—the Dacre (for day-fighters) and Ingpen (for all-weather squadrons)—have been won for 1958 by Nos. 63 and 85 Sqns. respectively.

* * * * *

The Gordon Shephard Memorial Prize Essay Competition for 1958 was won by S/L. E. J. Baker, an equipment officer at Air Ministry.

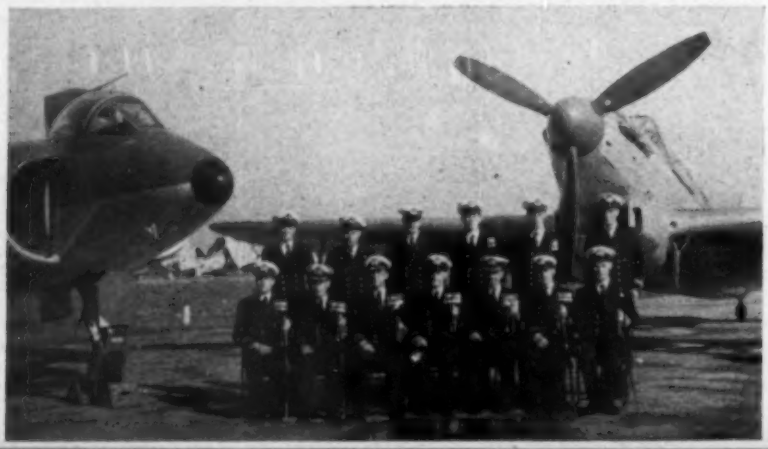
* * * * *

The Jolliffe Trophy, awarded annually for the most attractive and efficiently run airmen's dining hall on a home R.A.F. station, has been won this year by R.A.F. Waterbeach (Fighter Command).

* * * * *

Following the introduction of ballistic missiles into R.A.F. service, five new advanced trades have been established, mainly in technician ranks. These are missile fitter (system); missile fitter (control); missile fitter (guidance); missile fitter (propulsion); and missile test equipment fitter.

No. 807 Sqn., recently re-commissioned at R.N.A.S. Lossiemouth as the second R.N. Scimitar squadron, has as its badge an heraldic scimitar (seen below left, as it is displayed on the tail of the aircraft). In the group between a Scimitar and a Fulmar (with which the squadron was once equipped) are the C.O., Lt.-Cdr. K. A. Leppard—centre, front row—with Rear Admiral D. R. F. Cambell, F.O.F.T., on his right



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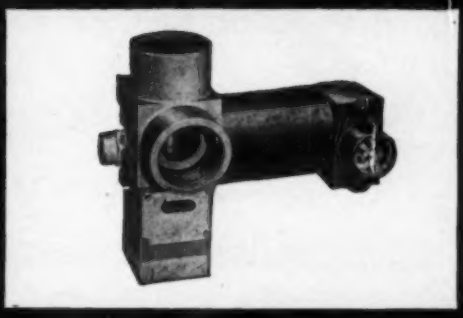

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PUBLIC ANNOUNCEMENTS

AIR TRANSPORT ADVISORY COUNCIL

THE AIR TRANSPORT ADVISORY COUNCIL give notice that they have received the undermentioned applications to operate scheduled air services.

FROM Tradair Ltd., of Southend Airport, Essex:—

APPLICATION No. 2272 for an All Freight Service with Viking aircraft on the route Southend - Rotterdam and/or Hamburg and/or Copenhagen and/or Malmo and/or Gothenburg and/or Stockholm at an initial frequency of eight return flights monthly increasing later to 30 return flights monthly for seven years from 1st January, 1959.

FROM British European Airways Corporation, of Keyline House, Ruislip, Middlesex:—

APPLICATION No. 2273 for a Normal Scheduled Service initially with Viscount aircraft and later also with Vanguard and Comet 4B aircraft for the carriage of passengers, supplementary freight and mail between London and Genoa (Christopher Columbus) at a frequency in accordance with traffic demand for ten years from the opening of Christopher Columbus Airport.

APPLICATION No. 2288 for a U.K. Internal Service initially with Pionair aircraft and later also with Viscount aircraft for the carriage of passengers, supplementary freight and mail on the route Liverpool and/or Manchester - Cardiff and/or Bristol - Jersey and/or Guernsey at a frequency in accordance with traffic demand for ten years from 1959.

FROM Pegasus Airlines, of 236 Old Bedford Road, Luton, Beds.:—

APPLICATION No. 2281 for a seasonal U.K. Internal Service initially with Viking aircraft and later also with DC-3 aircraft for the carriage of passengers, supplementary freight and mail between Luton and Jersey at an initial frequency of five return flights weekly increasing later in accordance with traffic demand from mid-May to mid-October each year for seven years from 1959.

FROM Orion Airways Ltd., of Blackbushe Airport, Camberley, Surrey:—

APPLICATION No. 2282 for a seasonal Normal Scheduled Service initially with Viking aircraft and later with Bristol 170 aircraft for the carriage of passengers, supplementary freight and mail between Coventry and Ostend at a frequency of four return flights weekly from May to October each year for seven years from 1959.

APPLICATION No. 2283 for a seasonal U.K. Internal Service initially with Viking aircraft and later also with Bristol 170 aircraft for the carriage of passengers, supplementary freight and mail between Coventry and Jersey at a frequency of four return flights weekly on Fridays, Saturdays and Sundays during May each year and seven return flights weekly on Fridays, Saturdays, Sundays and Mondays from June to September each year for seven years from 1959.

APPLICATION No. 2284 for an All Freight Service initially with Viking aircraft and later also with Bristol 170 aircraft on the route Coventry - Rotterdam and/or Antwerp and/or Dusseldorf at an initial frequency of one return flight weekly increasing later to seven return flights weekly for seven years from 1st January, 1959.

FROM the British Overseas Airways Corporation, of London Airport, Hounslow, Middlesex:—

APPLICATION No. 2287 for permission to include an optional traffic stop at Doha on the Normal Scheduled Services operated on Reserved Routes Nos. 1 to 6 as set out in Schedule 'A', Part I, of the Terms of Reference issued to the Council by the Minister of Civil Aviation on 30th July, 1952, and also on the Normal Scheduled Service approved under Application No. 339 (London - Abadan and/or Karachi).

FROM Transair Ltd., of Gatwick Airport, Horley, Surrey:—

APPLICATION No. 2289 for a Normal Scheduled Service with Viscount aircraft for the carriage of passengers, supplementary freight and mail between London (Gatwick) and Genoa (Christopher Columbus) at a frequency of five return flights weekly for seven years from the opening date of Christopher Columbus Airport.

THESE applications will be considered by the Council under the Terms of Reference issued to them by the Minister of Civil Aviation on 30th July, 1952. Any representations or objections with regard to these applications must be made in writing stating the reasons and must reach the Council within 14 days of the date of this advertisement, addressed to the Secretary, Air Transport Advisory Council, 3 Dean's Yard, London, S.W.1, from whom further details of the applications may be obtained. When an objection is made to an application by another air transport company on the grounds that they are applying to operate the route or part of route in question, their application, if not already submitted to the Council, should reach them within the period allowed for the making of representations or objections. [8428

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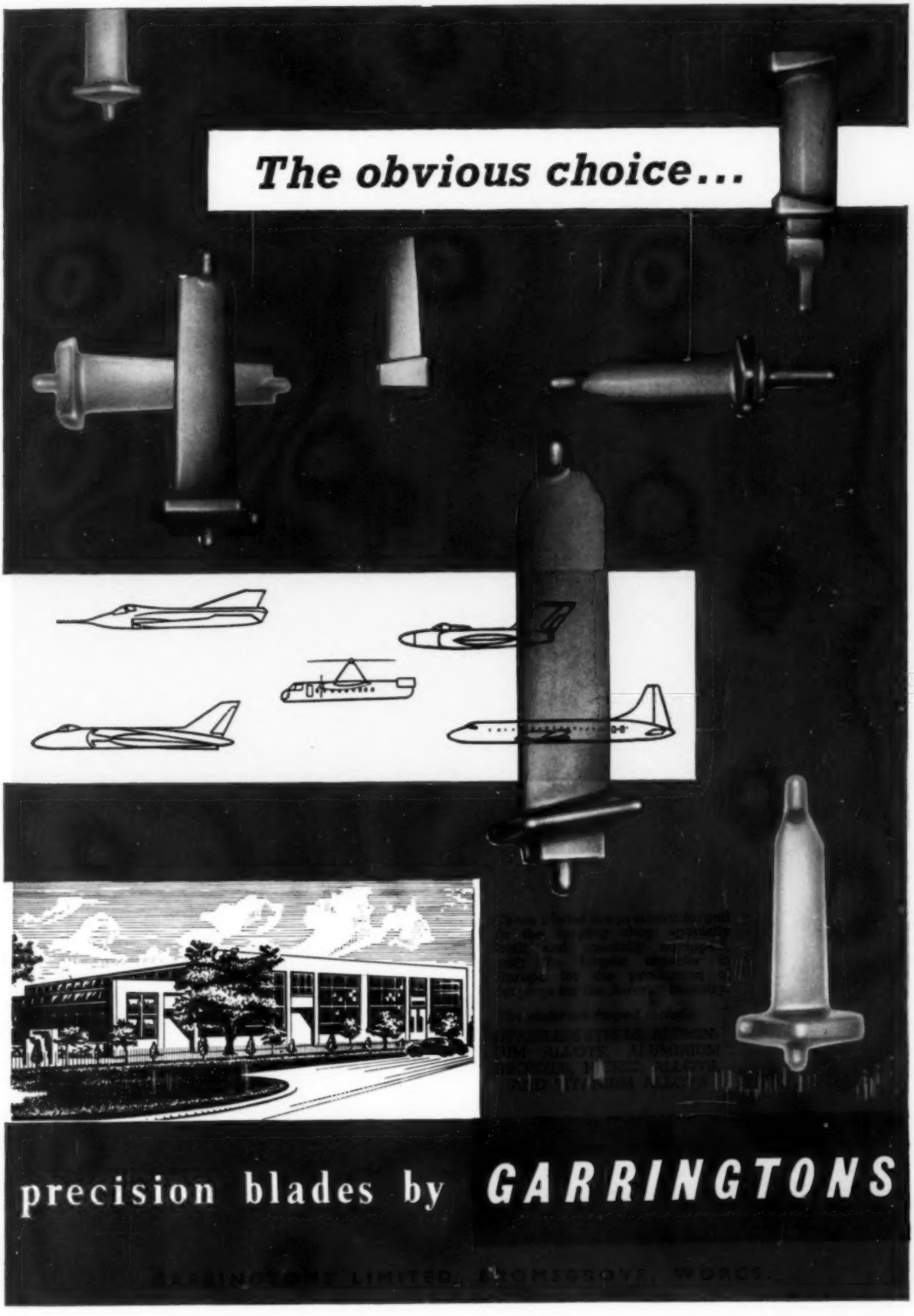
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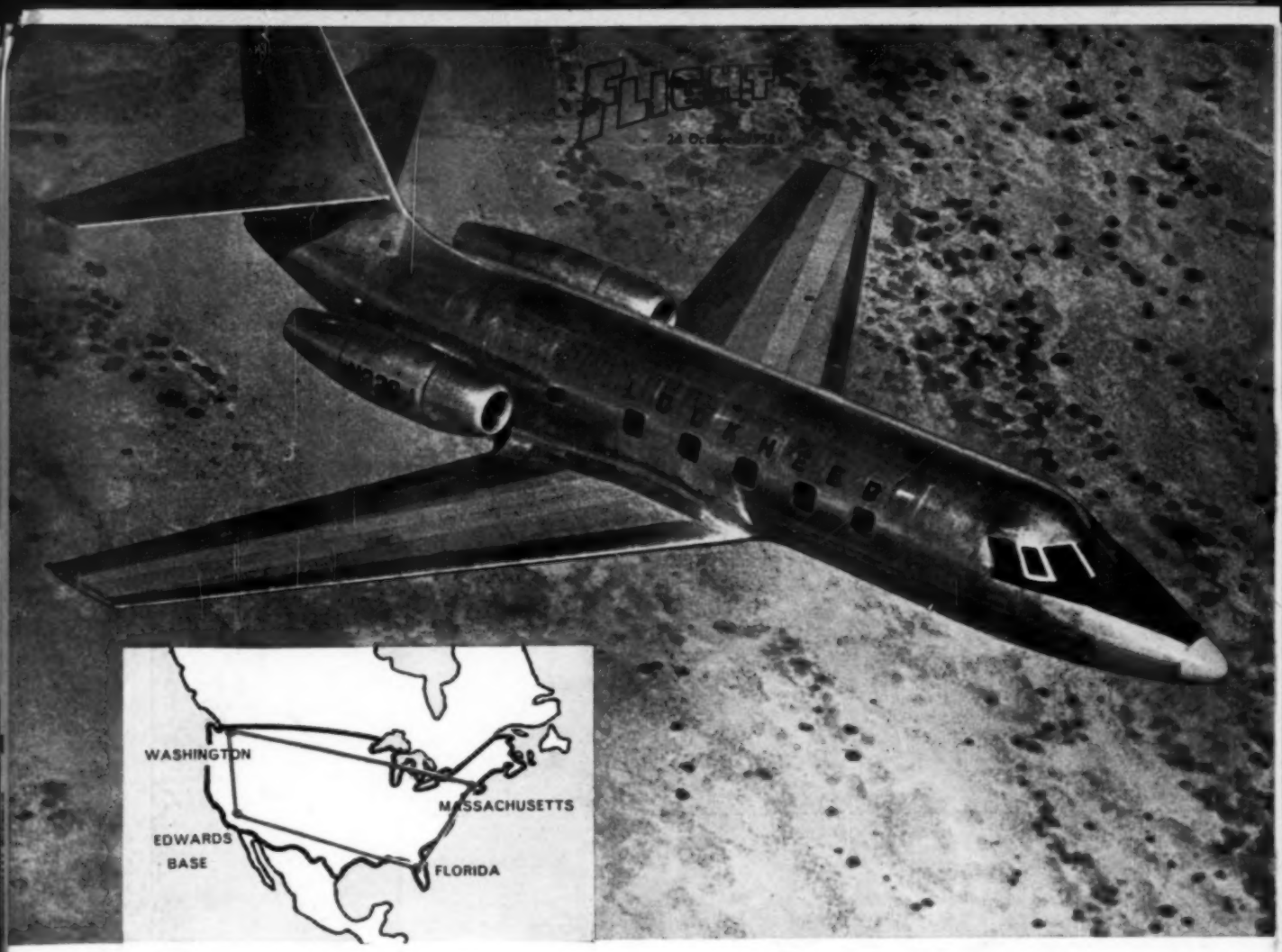

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